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Index to Illustrations	
Errata	
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CONTENTS OF VOLUME XL

No. 3

PAGE

The Game Fishes of India. Part V. By Dr. S. L Hora, D.SC., F.R.S.E., F.Z.S., F.R.A.S.B., F.N.I. (*With one coloured plate of the* Pungas Catfish *Pangasius pangasius*, (Hamilton) *and four text-figures*) 355

The Birds of Bombay and Salsette. Part V. By Sálim A. Ali, and Humayun Abdulali. (*With one black and white plate*) 367

The Birds of the Laccadive Islands. By F. N. Betts. (*With one black and white plate*) 382

The Taxonomic Description of *Rhinophis travancoricus* Boul. By Beni Charan Mahendra, F.Z.S. (*With one black and white plate*) 388

The Early Stages of Indian Lepidoptera. By D. G. Sevastopulo, F.R.E.S 391

Notes on some Indian Birds. By E. H. N. Lowther, M.B.O.U., F.Z.S. (*With six plates*) 409

The Reptiles and Amphibia of Cutch State. By C. McCann, F.L.S. (*With two plates*) 425

The Food of Brown Trout (*Salmo fario*). By Dr. Hamid Khan, Ph.D. (*With a plate*) 428

The Migration of Butterflies in India. By C. B. Williams, Sc. D. (*With one coloured plate and four diagrams*) 439

Where did the Sandalwood Tree (*Santalum album* Linn.) Evolve? By C. E. Fischer 458

Birds observed in and near Tambaram, Chingleput District, South India. By Alice M. Barnes 467

Protective Adaptation among some Indian Spiders. By T. V. Subrahmanyan. (*With one photo and three text-figures*) 477

The Indian Caddis Flies (*Trichoptera*). Part V. By Martin E. Mosely, F.R.S.E., F.Z.S. (*With twelve plates*) 486

An Additional List of Birds from Hyderābad State. By Sálim A. Ali 497

Supplementary Observations on the Munnar Section of the Ornithological Survey of Travancore and Cochin. By J. B. Primrose 500

MAR 1 1940

PAGE

PROPOSAL TO ADVANCE THE TEACHING AND RESEARCH IN ENTOMOLOGY IN INDIA. By M. Sharif, D.SC., Ph.D., F.L.S. 508
MEDICINAL AND POISONOUS PLANTS OF INDIA: WATER-LILIES, POPPYWORTS, FUMITORIES. By Rev. J. F. Caius, S.J., F.L.S. 513
PLANTS OF KUWAIT, NORTH EAST ARABIA. By Mrs. V. Dickson 528
A NOTE ON THE EMBRYOLOGY OF THE GROUND-NUT (*Arachis hypogaea* L.). By I. Bannerji. (*With two text-figures*)... 539
EARTH-EATING AND SALT-LICKING IN INDIA. ANALYSES. XL—XLVII. By Rev. J. F. Caius S.J., F.L.S., and Miss K. S. Radha, M. SC. 544

REVIEWS :—

I. The Fight to Live. By Raymond L. Ditmars..... 549
II. The Valley of Flowers. By Frank S. Smythe... 549
III. Lac Cultivation in India. By P. M. Glover........ 550
IV. Supplement to the Flowering Plants of Madras City and its Immediate Neighbourhood. By E. Barnes 550
V. Hints on Museum Education. By J. C Basak..... 550
VI. More Difficulties of the Evolution Theory. By Douglas Dewar 551
AN ASSURANCE 552

MISCELLANEOUS NOTES :—

I. Occurrence of Tiger in Northern Sikim, 8,800 ft. By Lt.-Col. F. H. Lister 553
II. Measurements of Tiger shot in the Nilgiris—1925–37. By Major E. G. Phythian-Adams. 553
III. Measurements of Panthers. By Major E. G. Phythian-Adams 554
IV. Measurements of Tiger, Panther, Bison and Sambhur. By R. C. Morris 555
V. Method adopted by Leopards in Hunting Monkeys. By Iftikhar Alikhan 555
VI. Otters and Crocodiles. By Lt.-Col. C. Howson... 557
VII. A Baby Elephant. By J. Ibbotson........ 558
VIII. Curious Behaviour of Elephants. By Major F. W. Haswell, I. A. 560

PAGE

IX. 'Stamping Grounds' and 'sore neck' in Sambar. By R. C. Morris 560
X. Occurrence of the White-headed Wagtail (*Motacilla flava leucocephala*) in the Attock District of the Punjab. By. H. W. Waite, M.B.O.U. 561
XI. Egg stealing of the Khasia Hills Cuckoo (*Cuculus canorus bakeri* Hart.) 561
XII. Call Notes of the Burmese Plaintive Cuckoo (*Cacomantis merulinus querulus*). By T. R. Livesey 564
XIII. The Shan Brown Wood-Owl (*Strix indranee shanensis*. Baker). By T. R. Livesey 567
XIV. Nesting of the Booted Eagle [*Hieraëtus pennatus* (Gmel.)] in the Simla Hills. By E. A. Jones... 568
XV. The Nidification of the Burmese Barred-backed Pheasant (*Syrmaticus humiae burmanicus*). By T. R. Livesey 568
XVI. An Extension of the Range of the Western Horned Pheasant [*Tragopan melanocephalus* (Gray)] 569
XVII. Game Birds in the Anaimalai Hills and the South Coimbatore District—*A correction*. By J. Williams 570
XVIII. Breeding of Pintail Snipe (?) in Belgaum District. By O. H. De St. Croix 570
XIX. Bird Notes from the Dry Zone of Upper Burma. By J. K. Stanford 571
XX. Swifts in Swallows' Nests. By Colonel Kenneth Comyn 575
XXI. On Cuckoos in Sugaon, Champaran District, Bengal. By F. A. C. Munns 576
XXII. A Comment on the name 'Blood-sucker' applied to [*Calotes versicolor* Daud.]. By B. Basu 577
XXIII. Extension of the range of the moth (*Norraca longipennis* Moore) (*Notodontidae*). By A.C. Harman 578
XXIV. Description of the Larva of *Eterusia* (*Soritia*) *leptalina* Koll. (*Zygaenidae*). By A. E. Jones. (*With a plate*) 578
XXV. Distribution of *Sternocera nitidicollis* C. and G. (*Buprestidae*). By H. G. Acharya, F.Z.S. 579
XXVI. The Distribution of *Butheolus melanurus* Kessler. By J. F. Caius 579

PAGE
XXVII. *Glyricidia maculata* as a shade-tree for Tea. By J. Williams ... 579
XXVIII. General Flowering of *Strobilanthes* in South India. By J. Williams ... 580
XXIX. A Fasciated Inflorescence in a Banana. By K. C. Jacob, L. Ag., F.L.S. (*With a photo*) ... 581
XXX. A Natural History Tale. By R. C. Morris ... 581
Proceedings—Bombay Natural History Society ... 582

No. 4

THE GAME FISHES OF INDIA. Part VI. By Dr. S. L. Hora, D.SC., F.R.S.E., F.Z.S., F.R.A.S.B., F.N.I. (*With one coloured plate of the* Goonch *Bagarius bagarius* (Hamilton) *and two text-figures*) ... 583
THE TWO-HORNED ASIATIC RHINOCEROS (*Dicerorhinus sumatrensis*). By Theodore Hubback. (*With eight plates*). 594
ADDITIONAL NOTES ON THE ASIATIC TWO-HORNED RHINOCEROS. By S. H. Prater, C.M.Z.S ... 618
THE BIRDS OF BOMBAY AND SALSETTE. Part VI. By Sálim Ali and Humayun Abdulali ... 628
NOTES ON THE DISEASES OF TROUT AT THE MAHILI HATCHERY—KULU (Punjab). By Dr. Hamid Khan, M.SC., LL.B., Ph.D. (*With a plate*) ... 653
NOTES ON BUTTERFLIES OF THE SHAN STATES, BURMA. By Capt. W. C. Carrott. ... 657
BIRD PHOTOGRAPHY IN INDIA. By Major R. S. P. Bates, M.B.O.U. (*With six plates*) ... 666
THE EARLY STAGES OF INDIAN LEPIDOPTERA. PART II. By D. G. Sevastopulo, F.R.E.S ... 681
THE MEDICINAL AND POISONOUS CRUCIFERS OF INDIA. By Rev. J. F. Caius, S.J., F.L.S ... 693
BOMBAY'S FISHING INDUSTRY. By Dr. S. B. Setna, M.SC., F.R.M.S., Ph.D ... 713
THE HABITS OF THE COMMON EARWIG OF ANNAMALAINAGAR, *Euborellia stali* (Dohrn.). By K. B. Thiagarajan, B.SC. ... 721
EARTH-EATING AND SALT-LICKING IN INDIA. By Rev. J. F. Caius, S.J., F.L.S., and Miss K. S. Radha, M.SC ... 724

REVIEWS:—

I. Pageant of Wings. By Douglas Gordon ... 727
II. Trees and Men. By E. Hughes-Gibb ... 727

PAGE

III. Le petit peuple des ruisseaux. Par Marcel Piponnier........ 728
IV. The Annual Report and Balance Sheet of the Ceylon Game and Fauna Protection Society for the Season 1937-38........ 728

MISCELLANEOUS NOTES :—

I. Why Elephants visit Salt-Licks. By T. Hubback. 730
II. The Mating of Elephants. By J. Gonzalez......... 731
III. Behaviour of Gaur or Indian Bison (*Bibos gaurus*). By F. J. Mustill, I.F.S........ 731
IV. Derivation of the name Seladang. By C. Gimson 733
V. Sore Neck in Sambar. By W. S. Thom........... 733
VI. The Record Thakin Head. By F. Wooley Smith. (*With a photo*)........ 736
VII. A Tree-Mouse (*Vandeluria aleracea*) in the nest of a Spider. By H. G. Acharya, F.Z.S.......... 737
VIII. Number of Young of Long-tailed Tree-Mouse (*Vandeluria oleracea*). By H. G. Acharya, O.F.Z.S........ 739
IX. Leopards from vicinity of Naga Hills. By G.H.L. Marshall........ 739
X. Measurements of Tigers shot in the Naga Hills (*A correction*). By G. H. L. Marshall........... 740
XI. Migration and Methods of Bird Snaring in North East Arabia. By Mrs. H. R. P. Dickson. (*With five text-figures*)........ 740
XII. Birds observed in and near Tambaram, South India. By Mrs. A. M. Barnes........ 744
XIII. The Distribution and Nidification of the Indian (Punjab) Raven (*Corvus corax laurencei* Hume) in Sind. By K. R. Eates, F.Z.S., M.B.O.U....... 747
XIV. A Note on the Resident Owls of Sind. By K. R. Eates, F.Z.S., M.B.O.U........ 750
XV. Vultures feeding at night. By T. R. Livesey..... 755
XVI. The Status and Nidification of the Persian Bee-eater (*Merops persicus persicus* Pall.) in Sind. By K. R. Eates, F.Z.S., M.B.O.U........ 756
XVII. Haunt and Habitat of *Pitta c. cucullata* Hartl, in W. Bengal. By S. C. Law. (*With a plate*)... 759
XVIII. On the occurrence of the Indian Purple Moorhen (*Porphyrio p. poliocephalus*) in Chitral. By H. S. Stansfeld........ 762

PAGE

XIX. On the occurrence of the Banded Crake (*Rallus e. amuroptera*) and the Malabar Woodpecker (*Macropicus j. hodgsoni*) in the Billigirirangan Hills, S. India. By R. C. Morris, F.Z.S., F.R.G.S. 763

XX. The Breeding of the Indian Sooty Tern (*Sterna fuscata infuscata*) in the Laccadive Islands. By F. N. Betts 763

XXI. Migration routes of Geese. By R. E. Parsons.... 764

XXII. Cotton Teal (*Nettopus coromandelianus*) at Nasik. By C. J. Rae 765

XXIII. 'Fish of Great Age'. By Peter Michael.... 765

XXIV. On the nesting Habits of the Gourami (*Osphronemus gorămy* [Lacépède]. By S. Jones.... 766

XXV. Fresh Water Fishes of North Gujrat. By H. G. Acharya, F.Z.S 772

XXVI. A case of poisoning from the bite of a Spider. By R. E. Parsons 773

XXVII. On the occurrence of certain Butterflies at Nasik. By C. J. Rae 775

XXVIII. An improved Cellophane wing mount. By D. G. Sevastopulo, F.R.E.S 775

XXIX. The Original Home of the Coconut (*A correction*). By P. V. Mayuranathan 776

XXX. Occurrence of two plants new to Kashmir. By P. N. Kohli 777

ALPHABETICAL LIST OF CONTRIBUTORS

VOLUME XL

Nos. 3 and 4

PAGE

ABDULALI, HUMAYUN; see ALI SÁLIM.

ACHARYA, H. G., F.Z.S.; Distribution of *Sternocera nitidicollis*, C.T.G. 579

——————; A Tree-Mouse (*Vandeluria oleracea*) in the nest of a Spider. 737

——————; Number of young of Long-tailed Tree-Mouse (*Vandeluria oleracea*) 739

——————; Fresh Water Fishes of North Gujrat 772

ALIKHAN, IFTIKHAR; Method adopted by Leopards in hunting Monkeys 555

ALI, SÁLIM; An additional List of Birds from Hyderabad State 497

—————— and ABDULALI, HUMAYUN; The Birds of Bombay and Salsette, Part V. (*With one plate*) 367

——————; Part VI 628

BANERJI, I.; A note on the Embryology of the Ground Nut, *Arachis hypogaea*, L. ... 539

BARNES, MRS. A. M.; Birds observed in and near Tambaram, Chingleput District, South India 467, 744

BASU, B.; A Comment on the name 'Blood-sucker' applied to *Calotes versicolor* (Daud.). 577

BATES, MAJOR R. S. P., M.B.O.U.; Bird Photography in India. (*With six plates*). 666

PAGE

BETTS, F. N.; The Birds of the Laccadive Islands (*With a plate*) 382

——————; The Breeding of the Indian Sooty Tern (*Sterna fuscata infuscata*) in the Laccadive Islands 763

CAIUS, J. F., S J., F.L.S.; Medicinal and Poisonous Plants of India: Waterlillies, Poppyworts, Fumitores 512

——————; The Distribution of *Butheolus melanurus* Kessler 579

——————; The Medicinal and Poisonous Crucifers of India 693

—————— and RADHA, MISS K. S.; Earth-Eating and Salt-Licking in India ... 544, 724

CARROTT, CAPT. W. C.; Notes on Butterflies of the Shan States, Burma 657

COBB, MAJOR E. H.; An extension of the Range of the Western Horned Pheasant [*Tragopan melanocephalus* (Gray)] 569

COMYN, COLONEL KENNETH; Swifts in Swallows' Nests ... 575

DE ST. CROIX, C. H.; Breeding of Pintail Snipe (?) in Belgaum District 570

DICKSON, MRS. H. R. P.; Migration and methods of Bird Snaring in North East Arabia. (*With five text-figures*) 740

DICKSON, MRS. V.; Plants of Kuwait, North East Arabia. 528

MAR 1 1940

PAGE
EATES, K. R., F.Z.S., M.B.O.U.; The Distribution and Nidification of the Indian (Punjab) Raven (*Corvus corax laurencei* Hume) in Sind ... 747
——— ; A Note on the Resident Owls of Sind ... 750
——— ; The Status and Nidification of the Persian Bee-eater (*Merops persicus persicus* Pall.) in Sind ... 756
EDITORS; Association of Deer and Monkeys 557
——— ; On the range of the Western Horned Pheasant (*Tragopan melanocephalus*)... 569
——— ; Extension of range of the moth *Norraca longipennis* Moore 578
——— ; Note on *Eterusia leptalina* Koll. 578
——— ; The largest head of a Mishmi Thakin 737
——— ; Banded Crake and Malabar Woodpecker in Southern India 763
——— ; Letter from Mr. Stuart Baker on identification of eggs of *Sterna fuscata infuscata* from Laccadive Islands 763
——— ; Nesting habits of the Gourami 771
——— ; Poisoning from bite of a spider (*Tarantula*) .. 774
FISCHER, C. E. C.; Where did the Sandalwood Tree (*Santalum album*, Linn.) Evolve? ... 458
GIMSON, C.; Derivation of the name Seladang 733
GONZALEZ, J.; The Mating of Elephants 731
HARMAN, A. C.; Extension of the range of the moth *Norraca longipennis* Moore. (*Notodontidæ*) 578
HASWELL, MAJOR F. W.; Curious Behaviour of Elephants 560
HORA, SUNDER LAL, D.SC., F.R.S.E., F.Z.S., F.R.A.S.B.; The Game Fishes of India, Part V. (*With one plate and four text-figures*) ... 355
HORA, SUNDER LAL, D.SC., F.R.S.E., F.Z.S., F.R.A.S.B.; The Game Fishes of India Part VI. (*With one plate and two text-figures*) 583
HOWSON, LT.-COL. C.; Otters and Crocodiles 557
HUBBACK, T.; The Two-Horned Asiatic Rhinoceros (*Dicerorhinus sumatrensis*). (*With eight plates*) 594
——— ; Why Elephants visit 'Salt-licks' 730
IBBOTSON, J.; A baby Elephant (*With a plate*) ... 558
JACOB, K. C., L. Ag., F.L.S.; A Fasciated inflorescence in a Banana (*With a plate*) ... 581
JONES, A. E.; Nesting of the Booted Eagle (*Hieraëtus pennatus* Gm.) in the Simla Hills 568
——— ; Description of the larva of *Eterusia* (*Soritia*) *leptalina* Koll. (*Zygænidæ*) (*With a plate*)... 578
JONES, S.; On the nesting Habits of the Gourami *Osphronemus gorämy* [Lacépède]. 766
KHAN, DR. HAMID, M.SC., LL.B., PH.D.; The Food of Brown Trout (*With a plate*). 428
——— ; Notes on the Diseases of Trout at the Mahili Hatchery—Kulu (Punjab) (*With a plate*) 653
KOHLI, P. N.; Occurrence of two plants new to Kashmir ... 777
LAW, S. C.; Haunt and Habitat of *Pitta c. cucullata* Hartl. in West Bengal (*With a plate*).. 759
LISTER, LT.-COL. F. H.; Occurrence of the Tiger in Northern Sikhim at 8,800 ft. 553
LIVESEY, T. R.; Egg stealing by Khasia Hills Cuckoo (*Cuculus canorus bakeri*), Hart. 561

PAGE

Livesey, T. R.; Call-notes of the Burmese Plaintive Cuckoo (*Cacomantis merulinus querulus*) 564
———; The Shan Brown Wood-Owl *Strix indranee shanensis* Baker ... 567
———; The Nidification of the Burmese Barred-back Pheasant (*Syrmaticus humiæ burmanicus*) ... 568
———; Vultures feeding at night 755
Lowther, E. H. N., m.b.o.u., f.z.s.; Notes on some Indian Birds—iii. Birds in my garden (*With six plates*) 409
Mahendra, Beni Charan, f.z.s.; The Taxonomic Description of *Rhinophis travancoricus*, Boul. (*With a plate*). 388
Marshall, G. H. L.; Leopards from vicinity of Naga Hills ... 739
———; Measurements of Tigers shot in Naga Hills (*A correction*) ... 740
Mayuranathan, P. V.; The original Home of the Coconut (*A correction*) 776
McCann, Charles, f.l.s.; The Reptiles and Amphibia of Cutch State. (*With two plates*) 425
Michael, Peter; 'Fish of Great Age' (*Reprinted from the 'Field'*) 765
Morris, R. C.; f.z.s., f.r.g.s. Measurements of Tiger, Panther, Bison and Sambhur ... 555
———; 'Stamping Grounds' and 'sore-neck in Sambar' 560
———; A. Natural History Tale 581
———; On the occurrence of the Banded Crake (*Rallus e. amuroptera*) and the Malabar Woodpecker (*Macropicus j. hodgsoni*) in the Billigirirangan Hills, S. India 763

PAGE

Moseley, Martin, E.; The Indian Caddis Flies (*Trichoptera*). Part V (*With twelve plates*) 486
Munns, F. A. C.; Cuckoos in Sugaon, Champaran District, Bengal 576
Mustill, F. J., i.f.s.; Behaviour of Gaur or Indian Bison (*Bibos gaurus*) 731
Parsons, R. E.; Migration routes of Geese 764
———; A case of poisoning from the bite of a spider 773
Phythian-Adams, Major E. G.; Measurements of Tigers shot in the Nilgiris—1925–37 553
———; Measurements of Panthers 554
Prater, S. H., c.m.z.s.; Additional Notes on the Asiatic Two-Horned Rhinoceros ... 618
Primrose, J. B.; Supplementary Observations on the Munnar Section of the Ornithological Survey of Travancore and Cochin 500
Radha, Miss K. S., m.sc.; See Caius, j.f., s.j., f.l.s.
Rae, C. J.; Cotton Teal (*Nettopus coromandelianus*) at Nasik. 765
———; On the occurrence of certain Butterflies at Nasik. 775
Reviews:—
  The Fight to Live 549
  The Valley of Flowers ... 549
  Lac Cultivation in India ... 550
  Supplement to the Flowering Plants of Madras City and its immediate neighbourhood 550
  Hints on Museum Education. 550
  More difficulties of the Evolution Theory 551
  Pageant of Wings 727
  Trees and Men 727
  Le petit peuple des ruisseaux. 728
  The Annual Report and Balance Sheet of the Ceylon

PAGE
Game and Fauna Protection Society for the Season 1937–1938 728
Setna, Dr. S. B., M.Sc., F.R.M.S., Ph.D. ; Bombay's Fishing Industry 713
Sevastopulo, D. G., F.R.E.S. ; The Early Stages of Indian Lepidoptera 391
———— ; The Early Stages of Indian Lepidoptera, Part 2 ... 681
———— ; An improved Cellophane wing mount 775
Sharif, M., D.Sc., Ph.D., F.L.S. ; A proposal to advance the Teaching and Research in Entomology in India ... 508
Smith, F. Wooley ; The Record Thakin Head (*With a photo*) 736
Stanford, J. K. ; Bird Notes from the Dry Zone of Upper Burma 571
Stansfeld, H. S. ; On the occurrence of the Indian Purple Moorhen (*Porphryrio p. poliocephalus*) in Chitral ... 762

PAGE
Subrahmanyam, T. V. ; Protective Adaptation among some Indian Spiders ... 477
Thiagarajan, K. B., B.Sc. ; The Habits of the Common Earwig of Annamalainagar, *Euborellia stali* (Dohrn.) ... 721
Thom, W. S. ; Sore Neck in Sambar 733
Waite, H. W. ; Occurrence of the White-headed Wagtail (*Motacilla flava leucocephala*, Przew.) in the Attock District of the Punjab ... 561
Williams, C. B., Sc.D. ; The Migration of Butterflies in India (*With one coloured plate and four diagrams*) ... 439
Williams, J. ; Game Birds in the Anaimalai Hills and the South Coimbatore District—*A correction* 570
———— ; *Glyricidia maculata* as a shade tree for Tea 579
———— ; General Flowering of *Strobilanthes* in South India 580

LIST OF PLATES

VOLUME XL

Nos. 3 and 4

PAGE

Game Fishes of India

Plate The Pungas Cat Fish (*Pangasius pangasius*) ... 355

Birds of Bombay and Salsette

Plate The Griffon Vulture (*Gyps fulvus*) 369

Birds of the Laccadive Islands

Plate I. (A) Coral Reef at Kadmat.
(B) Banyan grove at Kiltan 382
Plate *Rhinophis travancoricus*, Boul. 388

Notes on some Indian Birds

Plate I. Common Wood-Strike feeding its young ... 410
Plate II. The Chestnut-bellied Nuthatch 412
Plate III. Green Barbet looks out from its nest-hole ... 414
Plate IV. Little Brown Dove 416
Plate V. Ashy Wren-Warbler 420
Plate VI. Brown-backed Robin 422

Reptiles and Amphibia of Cutch State

Plate I. (A) Low Hills on the border of the Great Rann at Nir Wand, Pachum Island, Cutch
(B) The condition of the Great Rann, 15 miles north of Nir Wand, in September 1935 ... 425
Plate II. (A) Saw-scaled Viper or Phoorsa (*Echis carinata*) basking in a bush of *Capparis aphylla* in the Bunny, Cutch.
(B) Leith's Sand-snake (*Psamophis leithii*) at Nir Wand, Pachum Island 427

Food of Brown Trout (*Salmo fario*)

Plate Contents of stomach of a trout caught on the 11th April 1937 430

Migration of Butterflies in India

Plate Indian Migrant Butterflies
(A) *Colias fieldi.* (B) *Catopsilia crocale.* (C) *Vanessa cardui.*
(D) *Catopsilia pyranthe.* (E) *Lampides bœticus.*
(F) *Pieris brassicæ.* (G) *Danaus hamata septentrionis.*
(H) *Danaus genutiæ.* (I) *Euplœa core* 440

Indian Caddis Flies (*Trichoptera*)

Plate I. *Notidobia nigra* 487
Plate II. *Goëra atra* 488
Plate III. *Goëra kursea*, *Goëra kalimpa* 488
Plate IV. *Goëra minor* 488
Plate V. *Goëra mandana* 490
Plate VI. *Goëra mishmia* 490
Plate VII. *Goëra rumabia* 490

PAGE
Plate VIII. *Goëra tridens* 492
Plate IX. *Goëra vulpina* 492
Plate X. *Brachycentrus kozlovi* 495
Plate XI. *Micrasema baitina* 496
Plate XII. *Micrasema punjaubi* 496

A Baby Elephant

Plate Raj Piari with her mother 558
Plate *Eterusia* (*Soritia*) *leptalina*, (Koll) 578
Plate Fasciated Inflorescence in a Banana 581

Game Fishes of India

Plate The Goonch [*Bagarius bagarius* (Hamilton)] ... 583

The Two-horned Asiatic Rhinoceros (*Dicerorhinus sumatrensis*)

Plate I. Mounted heads 594
Plate II. Shot in steep country in Ulu Benus, Pahang ... 597
Plate III. Passing through a 'salt-lick' in Ulu, Pahang ... 601
Plate IV. Side view of animal shown in Pl. III 603
Plate V. A wallow near a 'salt-lick' 604
Plate VI. A disused wallow 607
Plate VII. The same animal shown in Pls. III and IV ... 610
Plate VIII. The same animal shown in Pls. III and IV ... 614

Notes on the Diseases of Trout at the Mahili Hatchery-Kulu (Punjab)

Plate. Fig. 1. Rainbow Trout showing Fin-rot.
Fig. 2. Rainbow Trout with Carcinoma of Thyroid.
Fig. 3. Brown Trout with Carcinoma of Thyroid ... 654

Bird Photography in India

Plate I. The hide 665
Plate II. Openbills in the Vedan Thangan Heronry ... 669
Plate III. Brown Hill-Warbler about to enter nest... ... 673
Plate IV. The Pheasant-tailed Jacana 674
Plate V. Yellow-billed Blue Magpie 676
Plate VI. Himalayan Ruby throat 678

Haunt and Habitat of *Pitta c. cucullata* Hartl. in West Bengal

Plate. Fig. 1. Swamp and march fed by overflow from river Banka
Fig. 2. Aspect of 'transition belt' along the course of the Banka 760

INDEX TO ILLUSTRATIONS

VOLUME XL

Nos. 3 and 4

PAGE

Arachis hypogaea, note on the Embryology of the Ground Nut
Figs. 1-8 540
Figs. 9-16 541
Asiatic Two-Horned Rhinoceros, (*Dicerorhinus sumatrensis*)
Pl. i. Heads. 594
Pl. ii. Specimen shot in Ulu Benus, Pahang ... 597
Pl. iii Passing through a 'salt-lick' in Ulu, Pahang 601
Pl. iv. Side view of animal shown in Pl. iii. 603
Pl. v. A wallow near a 'salt: lick'. 604
Pl. vi. A disused wallow ... 607
Pl. vii. Side view of animal shown in Pl. iii and iv ... 610
Pl. viii. Do. 614
Bagarius bagarius, Pl. ... 584
Fig. 1. Variation in form and colouration 583
Fig. 2. Teeth and alimentary canal 590
Bird Photography in India
Pl. i. The Hide 665
Pl. ii. Openbills in the Vedan Thangan Heronry ... 669
Pl. iii. Brown Hill-Warbler about to enter nest ... 673
Pl. iv. The Pheasant-tailed Jacana. 674
Pl. v. Yellow-billed Blue Magpie 676
Pl. vi. Himalayan Ruby-throat 678
Brachycentrus kozlovi
Pl. x. figs. 1-3 495
Catopsilia crocale, Pl. fig. B. ... 440

PAGE

Catopsilia pyranthe, Pl. fig. D. 440
Colias fieldii, Pl. fig. A. ... 440
Danaus genutiæ, Pl. fig. H. ... 440
——— *hamata septentrionis* Pl. fig. G. 440
Elephant (a Baby)
Raj Piari with her mother Pl. 558
Eterusia leptalina
Pl. figs. 1-3 578
Euploea core Pl. fig. 1. ... 440
Food of Brown Trout (*Salmo fario*)
Contents of the stomach of a Trout caught on the 11th April, 1937 430
Goëra atra
Pl. ii. figs. 1 and 2 488
——— *kalimpa*
Pl. ii. figs. 3 and 4 488
——— *kursea*
Pl. iii. figs. 1 and 2 488
——— *mandana*
Pl. v. figs. 1-6 490
——— *minor*
Pl. iv. figs. 1-5 488
——— *mishmia*
Pl. vi. figs. 1 and 2 490
——— *rumabia*
Pl. vii figs. 1-4 490
——— *tridens*
Pl. viii. figs. 1-4 492
——— *vulpina*
Pl. ix. figs. 1-7 492
Gyps fulvus Pl.
Nesting on the cliffs at Mumbra, Thana District, Bombay. (From a Group in the Prince of Wales Museum 368
Hersiliid spider on tree-bark fig. 482
Indian Caddis Flies (*Trichoptera*), Twelve plates ... 487-496

MAR 1 1940

PAGE

Laccadive Islands
  Pl. (a) Coral Reef at Kadmat
    (b) Banyan Grove at Kiltan ... 382
Lampides boeticus Pl. fig. E. ... 440
Micrasema baitina
  Pl. xi. figs. 1-4 496
———— *punjabi*
  Pl. xii. figs. 1 and 2 496
Migration and Bird Snaring in N. E. Arabia. ... ...
  Fig. 1. Three *Sulāba* traps. 741
  Fig. 2. A 'decoy' Kestrel. 742
  Fig. 3. Fakh trap 742
  Fig. 4. Sulāba trap ... 743
  Fig. 5. Sālia trap 744
Migration of Butterflies in India
  Pl. Indian Migrant Butterflies. 440
Musa paradisiaca
  Fasciated inflorescence in a Banana Pl. 581
Notidobia nigra
  Pl. 1. figs. 1-6 487
Pangasius hypophthalmus
  Fig. air-bladder 358
———— *larnaudii*
  Fig. dentition and air-bladder. 358
———— *micronena*
  Fig. dentition and air-bladder 358
———— *pangasius* Pl. ... 355
  Fig. 2. Lateral view of the large-eyed form 365
  Fig. 1. Upper dentition and air-bladder of 3 specimens... 357
  Fig. 4. Alimentary canal ... 365
———— *siamensis*
  Fig. dentition and air-bladder 358
Pieris brassicæ
  Pl. Fig. F. 440
Pitta c. cucullata
  Pl. fig. 1. Swamp and marsh River Banka
    fig. 2. 'Transition belt' River Banka ... 760
Prinia socialis
  Pl. 420
Psechrid Spider on grass fig. 482

PAGE

Rhinophis travancoricus
  Pl. A record example ... 388
Sitta castaneiventris
  Pl. 412
Stegodyphus sp. fig. 479
Streptopelia cambayensis
  Pl. 416
Tephrodornis pondicerianus
  Pl. ... 410
Thakin, a Record Head fig. ... 736
Thamnobia cambayensis
  Pl. ... 422
Thereiceryx zeylanicus
  Pl. ... 414
The Reptiles and Amphibia of Cutch State :—
  Pl. i. (*a*) Low Hills on the border of Great Rann at Nir Wand, Pachum Island
    (*b*) The condition of the Great Rann, 15 miles North of Nir Wand ... 425
  Pl. ii. (*a*) The Saw-scaled Viper or Phoorsa (*Echis carinata*) basking in a bush of *Capparis aphylla* in the Bunny, Cutch
    (*b*) Leith's Snake *Psamophis leithii* at Nir Wand, Pachum Island... 427
Thomisid spider in a Bauhinia flower fig. 483
Trout, Diseases of
  Pl. fig. 1. Rainbow Trout showing Fin-rot.
    fig. 2. Rainbow Trout with Carcinoma of Thyroid.
    fig. 3. Brown Trout with Carcinoma of Thyroid ... 654
Vanessa cardui, Pl. fig. C. ... 440

ERRATA

Vol. XL, No. 3

Page 501, line 14, from top, for '*XXVII*' read '*XXXVII*'.

,, 502, line 6, from bottom, for '*Not recorded. S.A.*' read '*S.A. and J. B. P.*'

,, 506, line 15, from top, for '*leschenauilt*' read '*leschenaulti*'.

,, ,, ,, ,, ,, ,, for '*Not seen*' read '*Not recorded*'.

INDEX OF SPECIES

PAGE
Aaronsohnia factorovskyi 531
Ablepharus grayanus 426
Acacia seyal 530
——— *sp.* 536
Acanthodactylus cantoris cantoris .. 426
Acantholepis orientalis 531
Accipiter nisus nisosimilis 746
——— virgatus besra 376
Achlaris bifasciatus casyapa 442
Acridotheres tristis tristis ... 412, 471
Acrocephalus dumetorum 503
——— stentoreus 571
Aemona lena 664
——— haynei 664
Aerua javanica 536
Ægithina tiphia humei 468
Æsalon chicquera chicquera 371
Æthiopsar fuscus mahrattensis ... 503
Aganais ficus 401
Agathia laetata 690
Aglais cashmirensis ... 398, 443, 450
Agrotis ypsilon 439
Aizoon canariense 531
——— hispanicum 531
Alauda gulgula australis 504
Albizzia lebbeck 539
Alcedo atthis 474
Alfalfa *sp.* 539
Alhagi maurorum 530
Alliaria officinalis 695
Allium desertorum 535
——— laceratum 535
——— sphærocephalum *var.* arvense. 535
Alseonax latirostris 469
Alseonax muttui 502
Alyssum maritimum 695
Amaranthus flitum 536
Amathusia phidippus friderici ... 665
Amathuxidia amythaon 665
Amaurornis fuscus fuscus 628
——— phœnicurus chinensis ... 629
——— ——— phœnicurus. 385
Ambassis ranga 773
Amblypharyngodon mola 773

PAGE
Ammi majus 531
Ammochloa palaestina 535
Ammomanes phœnicura 472
Anabasis articulata 533
——— setifera 533
Anadebis diademoides 664
——— himachala 664
Anagallis arvensis *var.* carnea ... 532
——— femina 532
——— latifolia 532
Anas platyrhyncha 650
——— pœcilorhyncha 574
——— ——— pœcilorhyncha... 650
Anastomus oscitans 645
Anchusa aggregata 532
Andrachne telephioides 534
Anhinga melanogaster 573, 644
Anisociadium lanatum 531
——— orientale 531
Anisolabis colossea 721
Ankyropetalum gypsophiloides ... 529
Annua (Ophiusa) coronata 689
Anous stolidus pileatus... 385
Anthemis deserti 531
Anthropoides virgo 632
Anthus hodgsoni hodgsoni 504
——— richardi richardi 497
——— rufulus malayensis 504
Antigone antigone antigone 632
Antirrhinum orontium 533
Anvillea garcini 532
——— garcine 536
Aporia agathon agathon 660
Appias albina ... 444, 446, 450
——— darada 661
——— lalage lalage 442, 443, 450, 661
——— lalassis 661
——— libythea olferna... 661
——— lyncida hippoides 661
——— nero galba 661
——— paulina adamsoni 661
Aquila nipalensis nipalensis ... 372
Arabidopsis thaliana 696
Arachis hypogaea 539

MAR 1 1940

PAGE
Arachnothera longirostra longirostra. 505
Ardea cinerea 573
—— —— cinerea 645
—— —— rectirostris 387
—— purpurea 573
—— —— manillensis 645
Ardeola grayii ... 387, 476, 507, 647
Arenaria interpres interpres ... 385, 636
Argemone mexicana 518
Argilops triunciatis 535
Argina argus 403
Argya caudata 576
—— —— caudata 468
—— gularis 571
Argynnis hyperbuis 454
—— lathonia issaea 456
Arhopalas dodonsea 456
—— ganesa 456
—— rama 456
—— *spp.* 442
Aristida ciliata 535
—— obtusa 535
—— plumosa 535
Arnebia cornuta 332
—— decumbens 532, 538
—— hispidissima 532
—— tinctoria 532
Artamus fuscus 470
Artemisia monosperma ... 532, 536
Arthrocnemum glaucum 533
Asio flammeus flammeus 367
Asota caricæ alciphron 402
Asphodelus tennifolius ... 535, 536
Astragalus annularis 530
—— baeticus 530
—— bombycinus 530
—— brachyceras 530
—— corrugatus 530
—— cruciatus 530
—— dactylocarpus 530
—— forskahlei 530
—— gyzensis 530
—— peregrinus 530
—— schimperi 530
—— striatellus 530
—— tenuirugis 530
—— tribuloides 530
Astur badius 746
—— —— dussumieri 375
Atella ariachne 444
—— phalanta 444, 445, 447

PAGE
Athene brama 474
—— —— indica 368, 754
Atractylis cancellata 532
—— flava 532
Atriplex dimorphastegia 533
—— leucoladum 533
—— parviflora 533, 538
Aulocera saraswata 455
Avena barbata 535
Bagarius bagarius ... 584, 585, 586, 587, 588
'—— buchanani' 584, 585
—— nieuwenhuisii, 584, 586, 588
'Bagrus yarrellii' 584, 585, 586
Baluchitherium 621
Barbarea vulgaris 696
Barbus arulius 773
—— sarana 773
—— sophore 773
—— *sp.* 773
—— ticto 773
Barilius bendelisis 773
Bassia eriopora 534
Bellevalia flexuosa 535
—— longipes 535
Beta maritima 534
Bibos frontalis 733
—— gaurus 731
Blepharis edulis 536
Botaurus stellaris stellaris 649
Brachmia xerophaga 737
Brachycentrus kozlovi 495
—— subnubilus ... 494, 495
Brachypternus benghalensis 473
Brachypteryx major albiventris ... 502
Brasenia schreberi 513
Brassica campestris 698
—— cernua 699
—— integrifolia 699
—— napus 697
—— nigra 699
—— oleracea 697
—— tournefortii 528
—— *var.* chinensis 698
—— —— rapa 698
Bromus tectorum 535
Bubo bubo bengalensis ... 368, 474, 753
—— coromandus coromandus ... 752
Bubulcus ibis 574
—— —— coromandus 646
Bufo andersonii 427

PAGE
Bungarus cæruleus ... 427
Bupleurum semicompositum ... 531
Burhinus œdicnemus ... 573
——— ——— *ssp.* ... 632
Butastur teesa ... 372, 572
Butheolus melanurus ... 579
Butorides striatus javanicus ... 387, 647
Buzura (Biston) suppressaria ... 691
Byasa aidoneus ... 658
——— aristolochiae ... 392
——— ——— goniopeltis ... 658
——— crassipes ... 658
——— philoxenus polyeuctes ... 658
——— zaleucus ... 658
Cacomantis merulinus querulus ... 564
Caerostris *sp.* ... 478
Caladium ... 682
Calamus castaneus ... 603
Calendula aegyptica ... 532
——— persica ... 532
Calidris tenuirostris ... 386
Callerebia hyagriva ... 454
——— scanda ... 454
Calligonum comosum ... 534
Calotes versicolor ... 426, 577
Calotrophis procera ... 534, 538
Capella gallinago gallinago ... 643
——— nemoricola ... 507, 643
——— stenura ... 507, 643
Capparis galeata ... 536
——— spinosa ... 536
Caprimulgus asiaticus asiaticus ... 474
Capsella Bursa-pastoris ... 701
Cardamine impatiens ... 701
——— pratensis ... 701
Carduus pycmocephalus *var.* arabicus. 532
Caretta caretta ... 425
Carpodacus erythrinus roseatus ... 504
Carrichtera annua ... 528
Carthamus oxyacantha ... 532
——— tinctorius ... 532
Casarca ferruginea ... 650
Cassia obovata ... 536
——— tomentosa ... 540
Catopsilia catilla ... 444, 445, 446, 447
——— crocale 394, 442, 443, 444, 445, 447, 450, 661
——— florella ... 444, 447, 450
——— ——— gnoma ... 661
——— pomona ... 450, 661

PAGE
Catopsilia pyranthe ... 442, 443, 444, 445, 446, 449, 450
——— ——— minna ... 661
Celastrina (Cyaniris) huegelii... ... 456
——— puspa ... 442, 454, 455
Cenchrus ciliaris... ... 535
Centaurea mesopotamica ... 532
——— phyllocephala ... 532
——— solstitialis ... 532
Centaurium (Erythraea) ramosissimum... 534
Centropus bengalensis ... 419
——— sinensis parroti ... 473, 505
Cephalaria syriaca ... 531
Ceratorhinus blythii ... 618
——— niger ... 618
Cerchneis tinnunculus tinnunculus ... 384
Ceryle rudis leucomelanura ... 474
Chætornis locustelloides ... 497
Chætura giganteus indicus ... 506
Chalcophaps indica indica ... 377, 506
Chaptia ænea malayensis ... 503
Chara vulgaris ... 534
Charadrius dubius ... 476
——— ——— curonicus ... 636
——— leschenaulti ... 637
——— mongolus atrifrons ... 637
Chaulelasmus streperus ... 650
Cheirianthus cheiri ... 702
Chela clupeoides ... 773
Cheliobrachys *sp.* ... 774
Chenopodium album ... 534
——— murale ... 534
Chettusia gregaria ... 638
Chilasa agestor agestor... ... 658
——— clytia clytia ... 393, 658
——— ——— onpape ... 658
——— slateri marginata ... 658
Chlidonias hybrida indica ... 634
Chloridea obsoleta ... 688
Chrysocolaptes festivus... ... 498
——— guttacristatus chersonensis... 505
Ciconia ciconia ciconia ... 645
Cinnyris asiatica asiatica ... 471
——— lotenia ... 471
——— minima ... 504
——— zeylonica ... 471
Circaëtus ferox ... 372
Circus æruginosus æruginosus 375, 475
——— macrourus .. 374, 385, 475, 746

PAGE
Circus melanoleucus 375, 475, 498
——— pygargus 375, 385
Cirrepedesmus leschenaulti 386
——— ——— mongolus artifrons ... 386
Cirrhina reba 773
Cirrhino cirrhosa 773
Cistanche tubulosa 533
Citrullus colocynthis 531, 536
Clamator jacobinus jacobinus 473, 576
Clupea chapra 592
Cochlearia flava 703
Colias 662
——— fieldi 442, 443, 450
——— ——— edusina 442, 457
Colisa fasciata (Colisa vulgaris) ... 767
——— labiosus 771
Collocalia fuciphaga unicolor ... 506
Colotis amata 450
Coluber helena 427
Columba livia 506
——— ——— intermedia 377
Convolvulus lineatus 532
——— oxyphyllus 532
——— pilosellaefolius 533
——— scriceus 533
Copychus saularis saularis 469
Coracias benghalensis indica 473
Corchorus triocularis 536
Cornulaca monacantha 534
Corvus corax laurencei 747
——— macrorhynchos culminatus. 467, 501
——— splendens 418, 467
——— ——— protegatus 501
——— ——— splendens 384
Corydalis govaniana 525
——— ramosa 526
Cosmolyce bœticus 443, 451
——— (Lampides) bœticus ... 399
Cosmophila erosa 690
Coturnix coromandelica ... 380, 572
——— coturnix coturnix 379
Crambe cordifolia 703
Crepis parviflora 532
Cressa cretica 533
Crocethia alba 386
Crocodilus palustris 425
Crocopus phœnicopterus chlorogaster 376
Crozophora obliqua 534
——— oblongifolia 534
Crucianella membranacea 531

PAGE
Cryophyton (Mesembryanthemum) nodiflorum 531
Cryptoplectron erythrorhynchum ... 507
Cuculus canorus bakeri 561
——— micropterus 576
Culicicapa ceylonensis ceylonensis ... 502
Cuminum cryminum 531
Cursorius coromandelicus 633
Cuscata planifora 533
Cutandia memphitica 535
Cynodon dactylon 535
Cynomorum coccineum 534
Cyornis rubeculoides rubeculoides ... 469
Cyperus arenarius 535
——— conglomeratus *var.* arenarius 535
——— rotundus 535
Cypsiurus parvus 474
Daemia cordata 536
Dafila acuta 650
Danais aglea 444
——— aglea melanoides 662
——— chrysippus 396, 662
——— gautama gautama 662
——— limniace 444, 445
——— ——— mutina ... 396, 662
——— melaneus plateniston 662
——— melissa septentrionis ... 662
——— plexippus 444, 445, 662
——— septentrionalis 444
——— tytia tytia 662
Danaus aglea 450
——— chrysippus ... 442, 443, 450
——— genutia 442,443,449,450,453,454,455
——— hamata septentrionis 449, 450, 453
——— limniace 450
——— plexippus 439
——— tytia 443, 450, 454, 455
Dasychira mendosa 404
Deilephila nerii 407
Delias aglaia 661
——— belladonna burmana 661
——— descombesi leucacantha ... 661
——— eucharis 661
——— hyparete hierte 661
——— sanaca 442, 443, 450, 456
——— singhapura agostina 661
——— thysbe pyramus 661
Delichon urbica urbica... 384
Demiegretta asha 387, 647
Dendrocalamus giganteus 602
Dendrocygna fulva 574

PAGE
Dendrocygna javanica 649
Dendrophasa pompadora affinis ... 376
Dercas verhuelii doubledayi 661
Descurainia sofia 703
Dicæum concolor concolor 505
Dicerorhinus sumatrensis 594
———— macrocercus peninsularis 470, 745
Digera arvensis 536
Dipcadi erythraeum 535, 536
Diplotaxis acris 528
———— harra 528
Dipsas trigonata 427
Discophora continentalis continentalis. 665
———— tullia zal 665
Dissoura episcopa episcopa 645
———— ———— episcopus 573
Draba muralis 704
Dromas ardeola 385, 633
Ducula badia cuprea 506
Dyera *spp.* 607
Echinopsilon muricatum 534
Echis carinata 427
Egretta alba subsp. 646
———— garzetta garzetta ... 574, 646
———— ———— intermedia 646
Elanus cœruleus 475
———— ———— vociferus ... 373, 385, 499
Elaunan bipartitus 722
Elymnias hypermnestra undularis 397, 664
———— nesœa timandra 664
Emberiza melanocephala 498
———— striolata striolata 497
Emex spinosus 534, 537
Enispe enthymius 665
Epeira diadema 478, 485
Eremopterix grisea grisea 471
Ergolis ariadne 450
Erites 664
Erodium ciconium 530
———— cicutarium 530
———— glaucophyllum 530
———— luciniatum 530
———— triangulare 530
———— ———— *var.* pulverulentum 530
Erolia alpina alpina 642
———— minuta minuta 642
———— temminckii 642
———— testacea 642
Erophila vulgaris 704
Eruca sativa *var.* eriocarpa 528
Erucaria allepica 529

PAGE
Erysimum repandum 705
Eryx johnii 426
Esacus recurvirostris 632
Eterusia (Soritia) leptalina 578
Euborellia stali 721
Euchloe lucilla 442, 443, 450
Eudynamis scolopaceus scolopaceus 384, 746
Eugenia *sp.* 608
Eumeces tæniolatus 426
Eumyias albicaudata 502
Euphorbia cornuta 534
———— hieroglyphica 534
Euplaoe alcathoe doubledayi 662
———— ———— oesatia 662
———— asela 453
———— core ... 444, 445, 449, 450, 453
———— ———— core 397
———— coreta 453
———— deione deione 663
———— diocletiana diocletiana ... 662
———— godarte 663
———— harrisi hopei 663
———— klugi crassa 663
———— ———— macclellandi 662
———— midamus brahma 663
Euryale ferox 514
Euthalia garuda 692
———— ———— suddhodana 398
Everes argiades 442, 443, 451, 454
Excalfactoria chinensis chinensis ... 498
Fagonia bruguieri 530
———— glutinosa 530
Falco jugger 371, 499
———— peregrinus... 384
———— ———— peregrinator ... 499
———— ———— peregrinus 371
———— subbuteo subbuteo 371
———— tinnunculus 475
———— ———— objurgatus 506
———— ———— tinnunculus ... 371
Farsetia aegyptia 529
———— aegyptiaca 706
———— hamiltonii 706
———— jacquemontii 705
Faunis arcesilaus 665
Felis tigris 553
Fibigia longisiliqua 529
Filago spathulata *var.* prostrata ... 532
Forficula auricularia 721
Francolinus pictus pictus 380
———— pondicerianus 476

PAGE
Frankenia pulverulenta 529
Fumaria indica 526
——— parviflora 526, 534
Gagea reticulata *var.* rigida 535
Galium decaisnei 531
——— sinaicum 531
Gallicrex cinerea 572, 629
Gallinula chloropus 572
——— ——— indicus 629
Galloperdix spadicea spadicea ... 379
——— ——— stewarti ... 507
Gallus gallus murghi 379
——— sonneratii 379, 507
Gandaca harina burmana 661
Garcinia *spp.* 608
Gastercantha *sp.* 478
Gastrocotyle hispidia *var.* songarica... 532
Gelochelidon nilotica nilotica ... 635
Geocichla citrina citrina 746
Gladiolus segetum 535
Glareola maldivarum 573
——— ——— maldivarum ... 633
Glaucidium radiatum radiatum ... 369
Glossogobius giuris 773
Glottis nebularia 386, 641
Glycestha aurota 443, 450
Glyricidia maculata 579
Glytothorax 585
Goëra atra 489
——— kalimpa 489
——— kursea 489
——— mandana 489
——— minor 489
——— mishmia 490
Gomalia elma albofasciata 775
Gonepteryx rhamni nepalensis ... 661
Gracula religiosa indica 503
Gymnarchus niloticus 768
Gymnodactylus kachensis kachensis ... 426
Gymnorhis xanthocollis 471
Gyps fulvus fulvescens 369
——— indicus 370
Gypsophila porrigens 529
Haematopus ostralegus longipes ... 636
Hætornis cheela melanotis 506
Halcyon smyrnensis fusca 505
——— ——— smyrnensis ... 474
Haliaëtus leucogaster 373, 385
Haliastur indus 373
——— ——— indus 475, 506
Haloxylon salicornicum ... 534, 538

PAGE
Haloxylon schweinfurthii 536
Haplophyllum tuberculatum ... 530, 537
Hebomoia glaucippe 444, 450
——— ——— glaucippe ... 662
Helianthemum ellipticum 529
——— kahiricum 529
——— ledifolium 529
——— lippii 529
——— salicifolium 529
Heliotropium undulatum ... 532, 536
Hemidactylus flaviviridis 426
Hemipus picatus picatus 503
Herinaria cinerea 533
——— hemistemon 533
Hestia lynceus hadeni 662
Heterotis niloticus 768
Hibiscus rosa sinensis 721
Hieraëtus fasciatus fasciatus ... 498, 506
——— pennatus 372, 568
Hierococcyx varius 576
Himantopus himantopus himantopus 639
Hippasa pantherina 480
Hippocrephis bicontorta 530
——— unisiliquosa 530
Hirundo daurica 575
——— ——— erythropygia ... 472
——— javanica domicola 504
Huphina lea 661
——— nerissa dapha 661
——— ——— evagete 394
Hydrophasianus chirurgus ... 572, 631
Hydrophis spiralis 427
Hymenocarpos mummularius ... 531
Hyoscyanus pusillus 533
Hypecoum pendulum 521, 528
——— procumbens 521
Hypolimnas bolina 445, 450
——— misippus 444, 450
Hypotaenidia striata striata 628
Hystrix leucura 625
Ibis leucocephala leucocephala ... 645
——— leucocephalus 573
Ichthyophaga ichthyaëtus 497
Ictinaetus malayensis perniger ... 372
Ifloga spicata 532
Impatiens *sp.* 682
Iris milesii 777
——— sisyrinchium 535
Isatis tinctoria 706
Ixias pyrene latifasciata 662
Ixiolirion montanum 535

PAGE
Ixobrychus cinnamomeus ... 574, 648
—— sinensis sinensis 648
Juncus acutus 535
Junonia hierta 444, 445, 447
—— lemonias 444, 445
—— orythya 444, 445
Kallima inachus 443, 455
—— —— heugelii ... 442, 450
—— philarchus horsfieldii ... 775
Ketupa ceylonensis leschenaulti ... 506
—— zeylonensis 368
—— —— leschenaulti ... 498
—— —— semenowi 751
Koeleria phleoides 535
Koelpinia linearis 532
Labeo boggut 772
—— calbasu 772
—— dussumieri 772
—— fimbriatus 772
—— potail 772
—— *sp.* 773
Labidura riparia 721
—— —— *var.* inermis ... 721
Lagerstraemia indica 685
Lalage sykesii 470
Lampides boeticus 442, 443
Lanius cristatus cristatus ... 384, 503
—— schach caniceps 470, 503, 745
—— vittatus 470
Lappula spinocarpos 532
Larus argentatus cachinnans ... 634
—— brunnicephalus 634
—— fuscus taimyrensis 634
—— hemprichii 634
—— ichthyaëtus 633
—— ridibundus 633
Launaea arabica 532
—— mucronata 532
—— nudicaulis 532
Leontodon hispidulum *var.* tenuilobum 532
Lepidium aucheri 529
—— crassifolium 707
—— draba 707
—— latifolium 708
—— perfoliatum 708
—— ruderale 529, 708
—— sativum 529, 706
Leptaleum filiforme 529
Leptocircus curius 660
—— meges indistincta ... 660
Leptosia nina nina 660

PAGE
Lethe bhadra 664
—— chandica flamona 663
—— distans 663
—— europa niladana 663
—— kansa 663
—— latiaris 663
—— mekara zuchara 663
—— muirheadi bhima 663
—— pulaha pulahoides 663
—— rohria rohria 663
—— sidonis 443
—— —— sidonis 663
—— —— vaivarta 450
—— sinorix 663
—— sura 663
—— vaivarta 442, 544
—— verma stenopa 663
—— vindhya 663
Leucage *sp.* 478
Leucocirca aureola 469
Leucopolius alexandrinus 386
Lilium giganteum 777
Limicola falcinellus subspecies ? ... 643
Limosa lapponica lapponica ... 640
—— limosa *ssp.* 640
Linaria chalepensis 533
—— micrantha 533
—— simplex *var.* flaviflora ... 533
Linum usitatissimum 535
Lissemys punctata granosa 425
Lithospermum callosum *var.* asperrimum 532
—— —— incrassatum 532
Lobipluvia malabarica ... 476, 638
Lobivanellus indicus 573
—— —— indicus 638
Loboda bifasciatus 443
—— —— casyapa 451
Locustella naevia stramenea 497
Loeflingia hispanica 529
Lolium rigidum 535
Lotus pusillus 531
Lybythea myrrha 455
Lycaenopsis huegelii 443, 451
—— puspa 443, 451
Lycosa annandalei 480, 485
Lycium arabicum 533
—— barbarum 533, 536
Lycodon striatus 427
Lygia passerina 534, 537
—— pubescens 534

PAGE
Lymnocryptes minima 644
Mabuya macularia 426
Machlolophus xanthogenys travancorensis 501
Macropicus j. hodgsoni 763
Macroplectra nararia 685
Macropodus chinensis (M.opercularis) 767
—— —— cupanus 767
—— —— opercularis 770
—— —— viridiauratus 770
Malcolmia africana 529
—— assyriaca 529
—— pulchella *var.* pygmaea ... 529
—— torulosa *var.* leiscarpa ... 529
Malva parviflora 530, 537
Mangifera indica 685
—— *sp.* 607
Mareca penelope 650
Mastacembelus armatus ... 591, 772
—— pancalus 772
Matthiola bicornis 529
—— incana 708
—— troida 529
Matricaria (Chamomilla) aurea ... 532
Meandrusa gyas aribbas 660
—— payeni amphis 660
Meconopsis aculeata 521
—— napaulensis 521
Medicago ascher soniana 531
—— laciniata 531
Melanitis leda ismene 664
—— zitenius zitenius 664
Melitotus indica 531
—— parviflora 531
Mergus merganser merganser ... 651
Merops orientalis orientalis 473
—— persicus persicus 756
—— superciliosus javanicus 473, 499
Metanastria hyrtaca 406
Metopidius indicus 630
Micrasema baitina 496
—— punjaubi 496
—— tristellum 495
Micropus affinis ... 474, 576, 746
—— melba bakeri 498
Microscelis psaroides ganeesa ... 501
Milvus migrans govinda 373, 385, 475, 506
—— —— lineatus 373
Mirafra assamica 572
Molpastes cafer cafer .. 468, 501, 744
—— haemorrhous... 419

PAGE
Monsonia nivea 530
Monticola solitaria pandoo 502
Morcandia arvensis 536
—— tortuosa 709
Mormonia vulpina 493
Motacilla cinerea caspica 504
—— flava leucocephala 561
—— —— simillima 504
—— —— maderaspatensis ... 471, 504
Musa paradisiaca 581
Muscadivora ænea pusilla 376
Muscari comosum 535
Muscicapula tickelliæ tickelliæ ... 502
Mycalesis francisca 663
—— gotama charaka 663
—— mamerta mamerta ... 663
—— mineus mineus 663
—— nicotia 663
—— perseus blaseus 663
—— suavolens 663
—— visala neovisala 663
Myiophoneus horsfieldii 502
Myristica *spp.* 608
Myrmarachne *sp.* 481
Mystus cavasius 773
Naia trupidans 427
Nasturtium fontanum 709
—— indicum 709
—— montanum 710
—— palustre 709
Natada suffusa 685
Nelumbium speciosum 514
Nelumbo nucifera 513, 514
Neophron percnopterus ... 370, 497
—— —— ginginianus ... 475
Neorina westwoodi 664
Nephila maculata 478
Neptis hylas ... 442, 443, 450
—— —— astola ... 454, 455, 456
Neptunia oleacea 540
Nerium odorum 691
Nettapus coromandelianus. 574, 649, 765
Nettion crecca crecca 387, 650
Neurada procumbens ... 531, 537
Nitraria tridentata 530
Norraca longipennis 578
Notidobia ciliaris 487
—— nigra 487
Notoceras bicorna 529
Notopterus notopterus 772
Numenius arquata lineatus 639

PAGE
Numenius arquata orientalis 386
——— phaeopus 386
——— ——— phaeopus... ... 640
Nuphar lutium 513
Nycticorax nycticorax nycticorax ... 648
Nymphæa alba 516
——— pubescens 517
——— rubra 516
——— stellata 517
Nyroca ferina ferina 651
——— fuligula fuligula ... 476, 652
——— marila marila 652
——— rufa rufa 498, 651
Ochradenus baccatus 529
Ochromela nigrorufa 502
Ocinara varians 407
Odontospermum pygmalum 532
Œnopopelia tranquebarica tranquebarica 378
Oligomeris subulata 529
Olios tiner 484
Onobrychis ptolemaica 531
Ononis reclinata 531
——— serrata 531
Ophicephalus punctatus 773
Ophioglossum vulgatum 535
Ophiomorus tridactylus 426
Ophiops jerdoni 426
——— microlepis 426
Orgyia postica 405
Orinoma damaris 664
Oriolus oriolus kundoo 471
Orobanche ægyptiaca 533
——— cernua *var.* desertorum ... 533
Orsotrioena medus medus 664
Orthotomus sutorius 420
——— sutorius guzurata ... 470
Osphronemus gorämy 766
Osphromenus gourämy 769
Otocompsa emeria 419
——— jocosa emeria ... 468, 744
——— ——— fuscicaudata ... 501
Otus bakkamoena deserticolor ... 753
—— brucei 368, 754
—— scops pulchellus 368
Oxalis corniculata 536
Pachypterus 584
——— luridus 584, 585
Palaquium *spp.* 608
Palystes flavidus 484
Pandion haliaëtus 369, 499

PAGE
Pandion haliaetus haliaëtus 384
Pangasius buchanani ... 356, 359, 362
——— djambal 358, 362
——— hypophthamus 357
——— juaro 358
——— larnaudii 357
——— macronema 358
——— pangasius 355, 362
——— siamensis 358
Panicum turgidum 535
Papaver argemone 523
——— dubium... 523
——— hybridum 523
——— nudicaule 525
——— orientale 525
——— rhoeas 522, 528
——— ——— *var.* subintegrum ... 528
——— somniferum 524, 528
——— ——— *var.* leptocanlolum ... 528
Papilio agestor 442, 443, 450
——— ——— govindra 456
——— arcturus arcturus 659
——— aristolochiæ 450
——— bianor gladiator 659
——— castor castor 659
——— chaon chaon 659
——— demoleus ... 444, 445, 450
——— ——— demoleus 659
——— erithonius 452
——— hector 444, 445, 450
——— helenus helenus 659
——— machaon ... 443, 450, 455
——— ——— verityi 659
——— mahadeva 659
——— memnon agenor 658
——— noblei 659
——— pammon 452
——— paris paris 659
——— polyctor ganesa 659
——— polytes ... 442, 443, 445, 450, 452, 454, 455
——— ——— romulus 659
——— protenor euprotenor 658
——— rhetenor 658
——— xuthus 659
Paranticopsis macareus gyndes ... 660
——— megarus similis... ... 660
——— xenocles kephisos ... 660
Parasa lepida 684
Parathyma opalina ... 442, 443, 450, 456

PAGE
Pareronia avatar avatar 662
——— valeria hippia ... 395, 662
Parnara mathias 446
Parnasa mathias 444
Paronychia arabica 533
——— argentea 529
Parralelia (Ophiusa) algira 689
Passer domesticus indicus 471
Pathysa agetes agetes 659
——— antiphates pompilius ... 659
——— aristeus hermocrates ... 659
——— glycerion 659
——— nomius swinhoei 659
Pavo cristatus 378
Payena *spp.* 608
Peganum harmala 530, 536
Pelecanus crispus 573
Pelopidas mathias 445, 451
Percnia ductaria 691
Perdicula argoondah 380
——— asiatica asiatica 380
Pericrocotus flammeus 503
——— peregrinus 470
Perina nuda 405
Pernis ptilorhynchus ruficollis ... 376
Peucitia elegans 482
——— virdiana 482
Phæthon indicus 386
Phalacrocorax niger 664
Phalanta phalanta ... 443, 450, 455
Phaseolus vulgaris 539
Philomachus pugnax 642
Phœniconaias minor 649
Phoenicopterus ruber antiquorum ... 649
Phœnicurus ochrurus 469, 745
Photoscotosia miniosata 691
Phragmites communis 535
Phylloscopus griseolus 499
——— nitidus 503
——— viridanus 503
Phytometra jessica 689
Picridium tingitanum *var.* subentegrum. 536
Picus xanthopygæus 505
Pieris brassicæ ... 442, 443, 447, 450
660
——— canidia indica 660
——— napi montana 660
——— saharæ 532
Pimelodus bagarius 585
——— pangasius 361, 362
Pimpinella puberula 531

PAGE
Pithecolobium *sp.* 608
Pitta brachyurs 585
Pitta brachyura ... 472, 505, 745
——— c. cucullata 759
Plantago albicans 533
——— amplexicaulis 533
——— ciliata 533
——— coronopus 533
——— cylindrica 533
——— lagopus 533
——— ovata 533
——— psyllium 533
Platalea leucorodia major 645
Ploceus philippinus 471
Pluvialis dominicus fulvus ... 386, 637
Podiceps ruficolls 476, 574
——— ——— capensis 651
Polycarpaea repens 529
Polycarpon tetraphyllum 529
Polycnemon *sp.* 534
Polygonum bellardi 534
Polyommatus boeticus 442, 444, 445, 446,
455
Polytela gloriosae 686
Pomatorhinus horsefieldi travancorensis. 501
Porphyrio poliocephalus poliocephalus. 499,
572, 630, 762
Porthesia (Euproctis) scintillans ... 406
Porzana parva 628
——— porzana 628
——— pusilla pusilla 628
Pratapa deva lila 399
Precis hierta 449, 450
——— iphita 442, 443, 450, 454, 455
——— lemonias 450
——— orithya 445, 450
Prinia flaviventris flaviventris ... 572
——— inornata 471
——— socialis 420, 471
——— sylvatica 471
Prioneris clemanthe 661
——— thestylis 661
Prodenia littoralis 686
Prosopis stephaniana 531
Psamophis condanarus 427
——— leithii 427
Pseudecheneis 585
Pseudogyps bengalensis ... 370, 475
Psittacula columboides 505
——— krameri manillensis ... 473
——— torquata 422

PAGE
Pteranthus dichotomus 533
Pterocles exustus ellioti 378
Ptyonoprogne rupestris 497
Puffinus pacificus hamiltoni 386
——— persicus 386, 644
Pulicaria crispa 536
Punica granatum 536
Pycnonotus luteolus luteolus 468, 744, 760
Pyctorhis sinensis sinenis 468
Querquedula querquedula 651
Rallus e. amuroptera 763
Rana cyanophlyctis 427
—— tigrina 427
Raphanus sativus 710
Rathinda amor 399
Recurvirostra avocetta avocetta ... 639
Reichardia tingitanta 532
Reseda arabica 529
——— decursiva 529
——— muricata 529
Rhanterium epapposum 532
Rhazya stricta 536
Rhinoceros 594
——— crossi 618
——— lasiotis .. 618, 619, 620
——— sondaicus ... 594, 596, 616, 619, 621
——— sumatranus 618
——— unicornis 619
Rhinophis travancoricus 388
Rhopodytes viridirostris 473
Rhyncholaba acteus 682
Rhynchops albicollis 636
Riparia concolor 504
Robbairea prostrata 529
Roemaria hybrida 528
Roselia fola 401
Rostratula benghalensis 573
——— ——— benghalensis. 631
Rumex pictus 537
——— *var.* bipinnatus ... 534
——— vesicarius 534
Rusa unicolor equinus 733
Salmo fario 428
Salsola hispidula 534
——— kali 534
——— longifolia 534
——— verrucosa 534
Salvia ægyptiaca 533
—— spinosa 533
Santalum album 458

PAGE
Sapium baccatum 608
Saponaria vaccaria 529
Saprolegnia 655
Sarcogyps calvus 369, 474
Sarkidiornis melanotus 649
Savignya oblonga 529
——— parviflora 529
Saxicola caprata 469
——— atrata... 502
——— burmanica 561
Saxicoloides fulicata 469
Scabiosa olivieri 531
——— palaestina 531
——— *var.* calocephala. 531
Schimpera arabica 529
——— persica 529
Scolopax rusticola rusticola ... 507, 643
Scorpiurus muricatus 531
Scorzonera papposa 537
Scrophularia deserti 533
Seetzenia orientalis 530
Senecio coronopifolius 532
Silene conica 529
—— conoidea 529
—— leyseroides 529
—— villosa 529
Sinapis (Brassica) arvensis 529
Siphia parva albicilla 502
Sisymbrium altissium 711
——— erucastroides 529
——— irio 711
——— loeselii 711
——— sophia 703
Sitana ponticeriana 426
Sitta castaneiventris 410
—— c. castanea 411
—— frontalis trontalis 501
Solanum nigrium 536
Spatula clypeata 651
Sphenopus divaricatus 535
Sphetta apicalis... 687
Spilarctia obliqua 402
Spilornis cheela... 372
——— nipalicus ... 442, 443, 451, 456
——— zaffra 456
Spodoptera mauritia 687
Squatarola squatarola squatarola ... 636
Statice spicata 532
——— suffruticosa 532
——— thouini 532
Stegodyphus 478

PAGE
Stegodyphus sarasinorum ... 737, 738
Sterna albifrons 385
—— —— albifrons 635
—— —— sinensis 574
—— anaetheta antarctica 385
—— —— fuligula 635
—— fuscata infuscata ... 385, 636, 763
—— repressa... 385
Sternocera nitidicolus 579
Stictopthalma louisa louisa 665
—— —— —— tytleri 665
Stipa tortilis 535
Streptopelia cambayensis 416
—— decaocto 572
—— —— decaocto ... 378
—— chinensis suratensis 377, 475, 507, 746
—— orientalis meena 377
—— senegalensis cambayensis 377, 475
Strix indranee indranee 384
—— —— shanensis 567
Strobilanthes 580
Sturnopastor contra contra 412
Suaeda baccata 534
—— vermiculata 534
Suastus gemius gemius... 400
Sula dactylatra melanops 644
—— fiber 386
—— sula rubripes 386
Sylepta derogata... 692
Syntaruches plinius 442, 454
—— —— telecanus 443
—— —— —— plinius 451
Sypheotides indica 632
Syrmaticus humix burmanicus ... 568
Tadorna tadorna 649
Tamarindus indicus 540
Tamarix articulata 530
—— macrocarpa 530
Tarsiger brunnea brunnea 502
Tchitrea paradisi 469, 503, 745
Teinopalpus imperialis imperatrix ... 660
Temenuchus pagodarum 471
—— —— p. pagodarum 745
Tephrodornis pondicerianus ... 410, 470
Teracolus amatus 449
Terias blanda silhetana ... 395, 662
—— hecabe 395, 442, 443, 449, 450, 454, 455,662
—— laeta ... 442, 443, 450, 454, 455, 662

PAGE
Terias libythea 442, 443, 450, 452, 455, 662
Terpsiphone viridis 576
Tetragnatha *sp.* 478
Teucrium oliverianum 533
—— polium 537
—— —— *var.* lanuginosum ... 533
Thalasseus bengalensis bengalensis 385, 635
—— —— bergii edwardsi 385
Thamnobia cambayensis 422
Thaumantis diores 665
Thauria aliris pseudaliris 665
—— lathyi amplifascia 665
Thereiceryx viridis 505
—— zeylanicus 414
Theretra oldenlandiae 681
Thlaspi arvense 712
Thyatira batis 684
Tordylium persicum 531
Torularia torulosa 529
Tragopan melanocephalus 569
Trapa bispinosa 630
Tribulus terrestris 530
Trichogaster labiosus 771
—— trichopterus 771
Trigonella anguina 531
—— hamosa 531
—— maritima 531
—— stellata 531, 538
Tringa erythropus 574
—— glareola 641
—— hypoleucos ... 386, 476, 507, 641
—— ochropus 507, 640
—— stagnatilis 641
—— totanus eurhinus 641
Trisetum pumilum 536
Trochalopteron jerdoni fairbanki ... 501
Troides aeacus 658
—— helena cerberus 658
Trypanophora semihyalina 400
Turdoides striatus polioplocamus ... 468
Turdus bourdilloni 502
—— simillimus mahrattensis ... 502
Turnix maculatus tanki 498
—— suscitator taijoor 381
—— sylvatica dussumieri 381
Tyto alba javanica 367
—— —— stertens 750
Udaspes folus 400
Upupa epops 474, 745
—— —— ceylonensis 505
Uroloncha malabarica 471, 745

PAGE
Uromastrix hardwickii 426
Urophyllum 608
Urospermum picroides 532
Utetheisa pulchella 402, 692
Valerianella leiocarpa 534
Vandeluria oleracea 737, 739
Vanessa canace 442, 443, 450, 455
—— cardui ...439, 442, 443, 445 447, 450
—— cashmirensis 442
Vararus molitoris 426
Varmina indica 404
Vicia peregrina 531
Wallago attu 773
Xantholæma hæmacephala ... 414, 745
—— —— indica ... 472
Xenentodon cancila 773
Xenorhynchus asiaticus 573
Xenus cinereus cinereus 640
Ypthima baldus baldus 664
—— hubneri hubneri 664

PAGE
Ypthima sakra austeni 664
—— savara 664
Zamenis diadema 427
—— ventrimaculatus 427
Zetides agamemnon 393
—— agammemnon agammemnon... 660
—— bathycles chiron 660
—— cloanthus 659
—— doson axion 659
—— eurypylus cheronus 659
—— sarpedon sarpedon 659
Zeuxidia amethytus masoni 665
Zizyphus mummularia 536
—— spina-christi 530, 538
—— —— *var.* inermis ... 530
Zosterops palpebrosa 422
—— —— egregia 384
—— —— nilghiriensis ... 504
Zygophyllum coccineum 530
Zypoetis scylax 664

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Madras Forest College, The Principal	Coimbatore.
Maharaja's College, The Principal	Ernakulam.
Medical College	Vizagapatam.
Mrs. A. V. N. College, The Principal	,,
Nowrosjee Wadia College, The Principal	Poona.
Oakgroove School, The Principal	Mussoorie.
Osmania University College	Hyderabad, Dn.
Osmania University, Head of Botany	,,
Pittapur Rajah's College	Cocanada.
Presidency College, The Principal	Madras.
Queen Mary's High School	Bombay.
Rajaram College, The Principal	Kolhapur.
Ravenshaw College	Cuttack.
Royal College of Medicine, The Professor	Baghdad.
Royal Institute of Science, The Principal	Bombay.
Samaldas College	Bhavnagar.

Colleges and Scientific Institutions—*continued.*

Secondary Training College	Bombay.
St. Berchman's College	Changanacherry
St. Mary's High School	Bombay.
Trivandrum, H. H. Maharaja's College for Women.	Trivandrum.
University College, The Principal	Rangoon.
University College, The Principal	Colombo.
Victoria Technical Institute, The Curator	Nagpur.
Wilson College, The Principal	Bombay.
Women's Christian College	Madras.
Colombo Museum, The Librarian	Colombo.
Colvin Lt.-Col. E. J. D. (I.A., C.I.E.)	Baroda.
Comyn, Col. Kenneth, (R.A.M.C.)	London.
Congreve, C. R. T.	Nilgiris.
Connor, Maj.-General Sir Frank (*Kt.*, D.S.O., F.R.C.S., I.M.S.)	England.
Conservator of Forests, Bhopal State	Bhopal.
Conservator of Forests, Cochin Government	Chalakkudi.
Conservator of Forests, Working Plan Circle	Maymyo.
Conservator of Forests, The Chief	Bombay.
Conservator of Forests, The Chief	Srinagar.
Cooper, Sir D. B. (*Kt.*, M.L.A.)	Satara.
Corbett, J. N.	Dikoya.
Cotton, Major J. C.	Burma.
Cowasji Jehangir, Sir, (Bart. K.C.I.E., O.B.E.)	Bombay.
Cowper, G. St. John	,,
Cox, C. E. C. (C.I.E., I.F.S., F.Z.S.)	Nagpur.
Coyajee, Miss Ratanbai H.	Bombay.
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Crawford, William G. (I.F.S.)	England.
Critchley, G.	Bombay.
Crofton, R. M. (I.C.S.)	Hyderabad, Dn.
Croix, O. H. de St.	Belgaum.
Crombie, A. D. (I.C.S.)	Madras.
Currie, A. J.	London.
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Darjeeling, The Cruator, Nat. Hist. Mus.	Darjeeling.
Daultara, Khan Bahadur Mian Ahmadyar (M.L.C.)	Multan.
Daver, Framroze, A.	Bombay.
Daver, The Hon'ble Mr. J. D. (Bar-at-Law)	,,
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Davis, D. (I.F.S.)	,,
Davis, G. (I.C.S.)	England.
Davis, P. W. (I.F.S.)	Coimbatore.
Davis, Dr. W. St. J.	Cachar.

Dean-Drummond, Lt.-Col. J.D.	Nilgiris.
Dee, Lionel	Coimbatore.
De Haas, C.P.J.	Java.
Delacour, Mons. Jean	France.
de Mello, Prof. Col. I. F.	Nova Goa.
Deo, Raja Sri Balavadra Narayan Bhunj	Keonjhargarh.
DeRhe Philipe, G. W. V. (F.E.S.)	London.
Deutsche Forschungsgemeinschaft, The Beschaffungsamt	Berlin.
Deutsches Entomologisches Institut der Kaiser Wilhelm	,,
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Dewas Junior, H. H. the Maharaja Saheb of	Dewas Jr.
Dewas Junior, Shreemant Capt. Y.B. Pawar, Yuvaraj, Dewas Junior Branch	,,
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Din, The Hon'ble Lt.-Col. Sir S. Hussum Ud (K.T., C.I.E.)	Peshawar.
Dinajpur, Maharaja Jagadish Nath Ray	Dinajpur.
Dinshaw, Kaikobad Cowasjee (C.I.E., J.P.)	Bombay.
Director of Museums, S. S. & F. M. States	Kuala Lumpur.
Dixie, Major W. J.	Karachi.
Dods, W. K.	Calcutta.
Donald, C. H. (F.Z.S.)	Dharmsala.
Donald, Capt. J. O. S.	Hangu.
Donovan, Lt.-Col. C. (I.M.S.)	England.
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Dubash, J. K.	Bombay.
Duke, A. H.	Bangkok.
Duke, Lt.-Col. C. L. B. (M.C., R.E.)	Roorkee.
Dunbar-Brander, A. A. (O.B.O. I.F.S.)	Scotland.
Dunbar, U. B. H.	England.
Duncan, Major D. L.	Wana.
Duncan, John E. (P.W.D.)	Rangoon.
Duncan, P. R. (I.F.S.)	Chakrata.
Duncan, Brigadier W. E. (D.S.O., M.C., R.A.)	London.
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Durand, C. H. S.	Bombay.
Dyson, R. A.	London.
Eates, K. R. (I.P., F.Z.S., M.B.O.U.)	Karachi.
Edwards, M. Vincent (I.F.S.)	Rangoon.
Eliot, John N.	Singapore.
Eliot-Lockhart, Capt. Wm.	London.
Ellis, Ralph	California.
Emerson, C. A.	Bombay.
Emerson, Gerald H. (I.C.S.)	England.
Emerson, Capt. J.	Bombay.
Etaiyapuram, The Rajah of	Etaiyapuram.
Evans, E. J.	Calcutta.
Evans, Col. G. H. (C.I.E., F.L.S.)	London.
Evans, Brigadier W. H. (C.S.I., C.I.E., D.S.O.)	England.

Ezra, Sir Alwyn (F.R.G.S., F.Z.S.)	Bombay.
Fawcus, L. R. (I.C.S.)	Calcutta.
Featherstone, Gordon B.	Assam.
Ferrar, Lt.-Col. M. L. (I.A., O.B.E.)	England.
Field, Major F. D. S. (I.A.) (O.B.E., M.C)	Aurangabad Dn.
Finnis, N. D'O.	Quetta.
Fischer, C. E., (R.E.)	Fatehgarh.
Fletcher, Thos. Bainbrigge (F.R.E.S., F.L.S.)	England.
Florence, James	Coonoor.
Flynn, A. A. (C.M.Z.S.)	England.
Fooks, H. A.	Calcutta.
Foot, A. E.	Dehra Dun.
Forrington, Arthur	Bombay.
Fountaine, Miss Margaret (F.E.S.)	London.
Fraser, A. G. (I.M.D.)	Nilgiris.
Fraser, Duncan	London.
Fraser, K. H.	Tellicherry.
Fraser, L. J. D.	Peshawar.
French Indo-China, His Majesty S. M. Bao-Dai, Emperor of Annam	F. I. China.
Frend, G. V. R.	Kadur.
Gardiner, J. E.	Nasirabad.
Garthwaite, P. F. (I.F.S.)	Maymyo.
Garbett, C. C. (C.S.I., C.M.G., C.I.E., F.R.G.S., I.C.S.)	Lahore.
Geddis, A.	Bombay.
Gee, E. P.	Badlipar.
Ghosh, S. K. (I.C.S.)	Shillong.
Gemmell, G. W.	Calcutta.
George, Hugh S. (I.F.S.)	Nagpur.
Gherardesca, Conte Georgeo, U. della	Italy.
Gibbon, Herbert	Vandiperiyar
Gibbons, J. M. B.	Bombay.
Gibson, Hon. Mr E. C. (C.I.E., I.C.S.)	Rajkot.
Gill, E. H. N. (F.Z.S.)	Sitapur.
Gill, H. A. C. (I.C.S.)	Delhi.
Gimson, C. (I.C.S.)	Imphal.
Gladstone, Capt. H. S. (F.Z.S. F.R.S.E.)	Scotland.
Glennie, Lt.-Col. E. A. (D.S.O., R.E.)	Dehra Dun.
Goodwin, F. W.	Simla.
Gordon, Major J. W.	Jodhpur.
Gore, C.	Assam.
Gough, Lt.-Col. W.	Dehra Dun.
Gould, B. J. (C.I.E., I.C.S. C.M.G.)	Gangtok.
Gouldsbury, C. P.	Mattupatti.
Gove, Capt R. V.	Bombay.
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Director of Agriculture, Baghdad	Iraq.
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Graham, Capt. G. K.	Peshawar.
Grant, F. A.	London.
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Gray, James	Devicolam.
Greaves, Mrs. D. I.	Bombay.
Greaves, J. B. (M.L.A.)	,,
Green, E. Ernest (F.E.S.)	England.
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Grier, J. A. B.	Sholapur.
Griffith, R. G.	Calcutta.
Gwalior, The Director of State Gardens	Gwalior.
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Hall, J. E.	Gaya.
Hambly, R. L.	Calcutta
Hamidkhan Bhatti, Dr. M. (M.SC., LL.B.)	Lyallpur.
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Hance, Lt.-Col. J. B. (O.B.E., I.M.S.)	Bangalore.
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Harper, Lt.-Col. A. Forrest	London,
Harper, William	Lahore.
Hartnoll, E. S. (I.F.S.)	Maymyo.
Harvey, Major C. W. L. (M.C.)	Alwar.
Hasted, Capt. J. S. Holy	England.
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Hawkins, R. E.	Bombay.
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Heaney, Major G. F. (R.E.)	Calcutta.
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Henry, H. A.	Karachi.
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Hewitt, Walter A.	Gorakhpur.
Heysham, R. K.	Bombay.
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Hora, Dr. Sunder Lal (D.SC.)	Calcutta.

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Hotz, Edwin	Delhi.
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Hughes, A. R.	Colombo.
Humphrey, J.	Bombay.
Hyderabad Dn., Economic Botanist to Government, C. A. Library	Himayatsagar, Dn.
Hyderabad Dn., Inspector-General of Forests	Hyderabad, Dn.
Imperial Council of Agricultural Research	New Delhi.
Inder, R. W. (I.F.S.)	Baroda.
Iron, C. S.	Coorg.
Irwin, Lt. H. R. H. F.	Delhi.
Isaacs Miss Mozelle (M.A., M.SC., B.T.)	Dombivli.
Ishwardas Lakhmidas (Sir, *Kt.*)	Bombay.
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Jacob, M. C. (I.F.S.)	Gauhati.
Jacobson, E. J H.	Calcutta.
James, E. R. Sherman	Assam.
James, J. N. A.	London.
Jamsetji M. Doctor (F.Z.S., C.M.Z.S.)	Bombay.
Jaora, H. H. Col. Sir Itikhor Alikhan, (K.C.I.E.) Nawab of	Jaora.
Jaunpur, Raja Sri Krishna Dutt Dube	Jaunpur.
Jawhar State, H. H. the Raja of Jawhar	Jawhar.
Jenkin, R. Trevor (I.F.S.)	England.
Jenning, E.	Thaton.
Jephson, Lt.-Col. M. D.	Bombay.
Jhalawar, H. H. The Maharaj Rana Rajendra Singh Bahadur	Brijnagar.
Johnson, Kay	Moran.
Joly, Dr. B. M.	London.
Jones, A. E.	Simla.
Jourdain, Rev. F. C. R.	England.
Jubbal, Rajkumar Digvijaichand, Heir Apparent of	Jubbal.
Junagadh, The Dewan of	Junagadh.
Kanga, Miss P. M. (M.SC.)	Bombay.
Karve, Prof. Janarden Nilkanth (M.SC.)	Poona.
Katrak, M. N.	Bandra.
Keatinge, H. A.	Rajshahi.
Keays, Lt.-Col. R. W. C. (I.A.)	Madras.
Kefford, H. Kingsley	Raipur.
Kemp, W. N. R.	Champaran.
Kempe, Hon'ble Mr. J. E.	England.
Kermode, C. W. D. (I.F.S.)	London.
Kerr, F. S.	Bombay.
Khan, Sahebzada Sardar Mahomed (J.P.)	Junagadh.
Khareghat, M. P. (I.C.S.)	Bombay.
Kiernander, Major O. G.	England.
Kirwan, Noel G. B.	Mangalor.

Koechlin, E. L.	Nilgiris.
Kohli, P. N.	Kashmir.
Kothavala, T. T.	Sukkur.
Krishnalal, Rai Bahadur Capt. (D.R.T.C., M.I.E. & S., A.F.R.A.S.)	Indore.
Kuroda, Dr. Nagamichi	Tokyo.
Kutch, M. K. Shree Fatehsinhjee of	Kutch.
Kyaw, Tun (I.F.S.)	Burma.
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Laidlay, J. C.	Scotland.
Lalkaka, Mrs. Mehra K. A.,	Bombay.
Lamb, Thos.	Calcutta.
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Landells, W. J.	Monywa.
Langdale, A. H.	Bombay.
Lastic, D. A. de	Burma.
Latif, Sarhan C.	Karachi.
Launey, Paul de	Comilla.
Lawther, B. C. A. (C.I.E.)	England.
Leach, Hon'ble Justice Sir Lionel	Madras.
Lees, L. M. (I.C.S.)	Burma.
Leland, A. J.	England.
LeMarchand, A. E. M.	,,
LeMarchand, W. M.	Dibrugarh.
Leonard, D. G.	Cochin.
Leonard, G. R.	Pahang.
Lewis, E. S.	Delhi.
LIBRARIES—	
Annamalai University Library	Annamalainagar.
Hyderabad, The State Library	Hyderabad, Dn.
Imperial Library, The	Calcutta.
Imperial Secretariat Library	New Delhi.
Lahore, University of Punjab, The Librarian	Lahore.
Lytton Library, Muslim University	Aligarh.
Madras, Connemara Public Library, The Principal Librarian	Madras.
Public Library, Museums and National Gallery of Victoria, The Chief Librarian	Melbourne.
Public Library, Museum and Art Gallery, Adelaide.	S. Australia.
United Service Library, The Honorary Secretary	Poona.
Lightfoot, Capt. G. S. (I.P.)	Darrang.
Lightfoot, S. St. C.	Taunggyi.
Lindsay, H. R.	Punalur.
Lindsay-Smith, Capt. J.	Assam.
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Lowndes, R. C.	Bombay.
Lowther, E. H. N. (F.Z.S., M.B.O.U.)	Moradabad.

Lucknow, Provincial Museum, The Curator	Lucknow.
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MacLachlan, R. B. (C.I.E.)	Ireland.
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Maitra, D. P.	Calcutta.
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Mankapur Raj, Raja Ambikeshwar Pratap Singh Saheb (M.L.C.)	Mankapur.
Marine Biological Laboratory	Mass, U.S.A.
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Matthews, W. H.	Rungli-Rungliot.
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Maxwell, Hon'ble Sir Reginald (I.C.S., K.C.S.I.)	Delhi.
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McGusty, H. M.	,,
McLeod, Major-Genl. D. K.	Burma.
McPherson, James	England.
McSweney, Capt. P. M. (I.M.S.)	Poona.
Mehta, Sir Hormasji, *Kt.*	Bombay.
Mehta, Jamshed N. R.	Karachi.
Mehta, K. M.	Bhavnagar.
Meinertzhagen, Lt.-Col. R.	London.
Menesse, N. H. (I.S.E.)	Hyderabad, Sind.
Meston, D. C.	Assam.
Milbank, Capt. M. V.	England.
Milburne, W.	Barjuli.
Miller, G. D. L.	Assam.
Mills, J. P. (I.C.S.)	,,
Mirchandani, U.M. (I.C.S.)	Sukkur.
Mistri, Dr. J. D.	Bombay.
Mitchell, Leonard	England.
Mohr, Dr. V. der Meer	Medan, Sumatra.
Monteath, J. (C.I.E., I.C.S.)	Junagadh.
Montmorency, Sir Geoffrey de (K.C.V.O., K.C.I.E., C.B.E., I.C.S.)	England.
Mooney, H. F. (I.F.S.)	Ranchi.
Moore, Major A. C (I.A.)	Burma.

Moore, John	London.
Moore, R. J. Arthur	Travancore.
Mordern, William J.	U. S. A.
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Morgan, Vernon	Agra.
Morrison, Lt.-Col. John (I.M.S.)	London.
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Morton, Geo. B.	Calcutta.
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Mott, John L.	New York City.
Mullen, G. R.	Bombay.
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Murphy, P. J.	Ramna, Dacca.
Mustill, F. J.	Maymyo.
Mysore, Government Museum, The Superintendent ...	Bangalore.
Mysore, Chief Conservator of Forests	,,
Nagpur, Central Museum, The Curator	Nagpur.
Naik, Dr. R.N. (G.B.V.C.)	Bombay.
Needham, F. M.	Assam.
Nevill, Capt. T. N. C.	London.
Newcome, Lionel	Somwarpet.
Nichols, Rev. Edward G	Madura.
Nicholson, Lt.-Col. M.A. (I.M.S.)	Indore.
Nicolaus, G. R. (F.R.G.S., F.Z.S.)	London.
Nilgiri Game Association	Ootacamund.
Nilgiri, H. H. The Rajah Saheb of	Raj-Nilgiri.
Nimaj, The Chief Saheb of	Nimaj.
N. W. F. Province, His Excellency The Governor of	Peshawar.
Ogilvie, C. S.	Pahang.
Oliver, A. W. L.	Singapore.
Orchha State, H. H. The Sawai Mahendra Maharaja Bahadur	Tikamgarah.
Orissa, H. E. The Governor of	Orissa.
Ortcheson, J. (I.C.S.)	Gujrat.
Osborn, Mrs. Gladys	Bombay.
Osborne, E. T.	Poona.
Osborne Jones, M. T.	Trichinopoly.
Osmaston, B. B. (C.I.E., I.F.S.)	England.
Osmaston, F. C. (I.F.S.)	Chaibassa.
Oxley, Lt. Col. J. C. S. (I.M.S.)	Srinagar.
Palacios de Borao, Rev. G. (S.J.)	Bombay.
Palanpur, H. H. Sir Nawab Saheb Taley Mahomed, Khan Bahadur (K.C.I.E., K.C.V.O.) of ...	Palanpur.
Palmer, R.W.V.	Rangoon.
Palmes, W.T. (I.C.S.)	Kenya.
Panday, Mrs. J. L.	Bombay.
Parker, Mrs. M.	,,
Parr, C. I.	Samastipur.
Parsons, R. E. (I. P.)	Nowgong.
Partabgarh, H. H. Maharawat Sir Ramsinhji Bahadur (K.C.S.I.)	Partabgarh.
Paterson, E. A.	Calcutta.

Paterson, J. J.	Hongkong.
Patna State, Maharaja Rajendra Narayan Singh Deo	Balangir.
Patten, Hugo J.	Edinburgh.
Patterson, A.	London.
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Pazze, Peter P.	,,
Peart, Major J. F.	Manzai.
Peppe, F. H.	Dehra Dun.
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Petit Institute, J. N., Honorary Secretary	Bombay.
Petit, F. C.	,,
Petit, S. C. D.	,,
Petrie, W. M.	,,
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Picton Major, F.C. (R.A.)	Dehra Dun.
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Popple, W. G.	Bombay.
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Preeston, R. A.	England.
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CONTENTS OF VOLUME XL, No. 3.

PAGE

The Game Fishes of India, Part V. By Dr. S. L. Hora, D.Sc., F.R.S.E., F.Z.S., F.R.A.S.B., F.N.I. (*With one coloured plate and 4 text-figures*) ... 355

The Birds of Bombay and Salsette, Part V. By Sálim A. Ali, and Humayun Abdulali. (*With one black and white plate*) ... 367

The Birds of the Laccadive Islands. By F. N. Betts. (*With one black and white plate*) ... 382

The Taxonomic Description of *Rhinophis travancoricus* Boul. By Beni Charan Mahendra, F.Z.S. (*With one black and white plate*). 388

The Early Stages of Indian Lepidoptera. By D. G. Sevastopulo, F.R.E.S. ... 391

Notes on Some Indian Birds. By E. H. N. Lowther, M.B.O.U., F.Z.S. (*With 6 plates*) ... 409

The Reptiles and Amphibia of Cutch State. By C. McCann, F.L.S. (*With two plates*) ... 425

The Food of Brown Trout (*Salmo fario* L.). By Dr. Hamid Khan, Ph.D. (*With a plate*) ... 428

The Migration of Butterflies in India. By C. B. Williams, Sc.D. (*With one coloured plate and 4 diagrams*) ... 439

Where did the Sandalwood Tree (*Santalum album* Linn.) Evolve? By C. E. C. Fischer ... 458

Birds observed in and near Tambaram, Chingleput District, South India. By Alice M. Barnes ... 467

Protective Adaptation Among Some Indian Spiders. By T. V. Subrahmanyam. (*With one photo and three text-figures*) ... 477

The Indian Caddis Flies (*Trichoptera*). Part V. By Martin E. Mosely, F.R.E.S., F.Z.S. (*With 12 plates*) ... 486

An Additional List of Birds from Hyderābad State. By Sâlim A. Ali ... 497

Supplementary Observations on the Munnar Section of the Ornithological Survey of Travancore and Cochin. By J. B. Primrose ... 500

A Proposal to Advance the Teaching and Research in Entomology in India. By M. Sharif, D.Sc., Ph.D., F.L.S. ... 508

Medicinal and Poisonous Plants of India: Waterlilies, Poppyworts, Fumitories. By Rev. J. F. Caius, S.J., F.L.S. ... 513

Plants of Kuwait, North East Arabia. By Mrs. V. Dickson ... 528

A Note on the Embryology of the Ground Nut (*Arachis hypogaea* L.). By I. Banerji. (*With two text-figures*) ... 539

Earth-Eating and Salt-Licking in India. Analyses XL-XLVII. By Rev. J. F. Caius, S.J., F.L.S., and Miss K. S. Radha, B.Sc. ... 544

REVIEWS:—

I.—The Fight to Live. By Raymond L. Ditmars ... 549

II.—The Valley of Flowers. By Frank S. Smythe ... 549

III.—Lac Cultivation in India. By P. M. Glover ... 550

IV.—Supplement to the Flowering Plants of Madras City and its Immediate Neighbourhood. By E. Barnes ... 550

V.—Hints on Museum Education. By J. C. Basak ... 550

VI.—More Difficulties of the Evolution Theory. By Douglas Dewar ... 551

An Assurance ... 552

PAGE

MISCELLANEOUS NOTES :—

I.—Occurrence of Tiger in Northern Sikkim 8,800 ft. By Lt.-Colonel F. H. Lister.......... 553

II.—Measurements of Tigers shot in the Nilgiris—1925–37. By Major E. G. Phythian-Adams.......... 553

III.—Measurements of Panthers. By Major E. G. Phythian-Adams. 554

IV.—Measurements of Tiger, Panther, Bison and Sambhur. By R. C. Morris.......... 555

V.—Method Adopted by Leopards in Hunting Monkeys. By Iftikhar Alikhan.......... 555

VI.—Otters and Crocodiles. By Lt.-Col. C. Howson.......... 557

VII.—A Baby Elephant. By J. Ibbotson.......... 558

VIII.—Curious Behaviour of Elephants. By Major F. W. Haswell, I.A.......... 560

IX.—'Stamping Grounds' and 'Sore Neck' in Sambar. By R. C. Morris.......... 560

X.—Occurrence of the White-headed Wagtail [*Motacilla flava leucocephala* (Przewalski)] in the Attock District of the Punjab. By H. W. Waite, M.B.O.U.......... 561

XI.—Egg Stealing by Khasia Hills Cuckoo (*Cuculus canorus bakeri* Hartert). By T. R. Livesey.......... 561

XII.—Call Notes of the Burmese Plaintive Cuckoo (*Cacomantis merulinus querulus*). By T. R. Livesey.......... 564

XIII.—The Shan Brown Wood Owl (*Strix indranee shanensis* Baker). By T. R. Livesey.......... 567

XIV.—Nesting of the Booted Eagle (*Hieraëtus pennatus* [Gmelin]) in the Simla Hills. By A. E. Jones.......... 568

XV.—The Nidification of the Burmese Barred-back Pheasant (*Syrmaticus humiæ burmanicus*). By T. R. Livesey.......... 568

XVI.—An Extension of the Range of the Western Horned Pheasant (*Tragopan melanocephalus* [Gray]). By Major E. H. Cobb.......... 569

XVII.—Game Birds in the Anaimalai Hills and the South Coimbatore District—A correction. By J. Williams.......... 570

XVIII.—Breeding of Pintail Snipe (?) in Belgaum District. By O. H. De St. Croix.......... 570

XIX.—Bird Notes from the Dry Zone of Upper Burma. By J. K. Stanford.......... 571

XX.—Swifts in Swallows' Nests. By Colonel Kenneth Comyn.......... 575

XXI.—On Cuckoos in Sugaon, Champaran District, Bengal. By F. A. C. Munns.......... 576

XXII.—A Comment on the name 'Bloodsucker' Applied to [*Calotes versicolor* (Daud.)]. By B. Basu.......... 577

XXIII.—Extension of the Range of the Moth *Norraca longipennis* Moore (*Notodontidæ*). By A. C. Harman.......... 578

XXIV.—Description of the Larva of *Eterusia* (*Soritia*) *leptalina* Koll. (*Zygaenidae*). By A. E. Jones (*With a plate*).......... 578

XXV.—Distribution of *Sternocera nitidicollis* C. and G. (*Buprestidae*). By H. G. Acharya, F.Z.S.......... 579

XXVI.—The Distribution of *Butheolus melanurus* Kessler. By J. F. Caius.......... 579

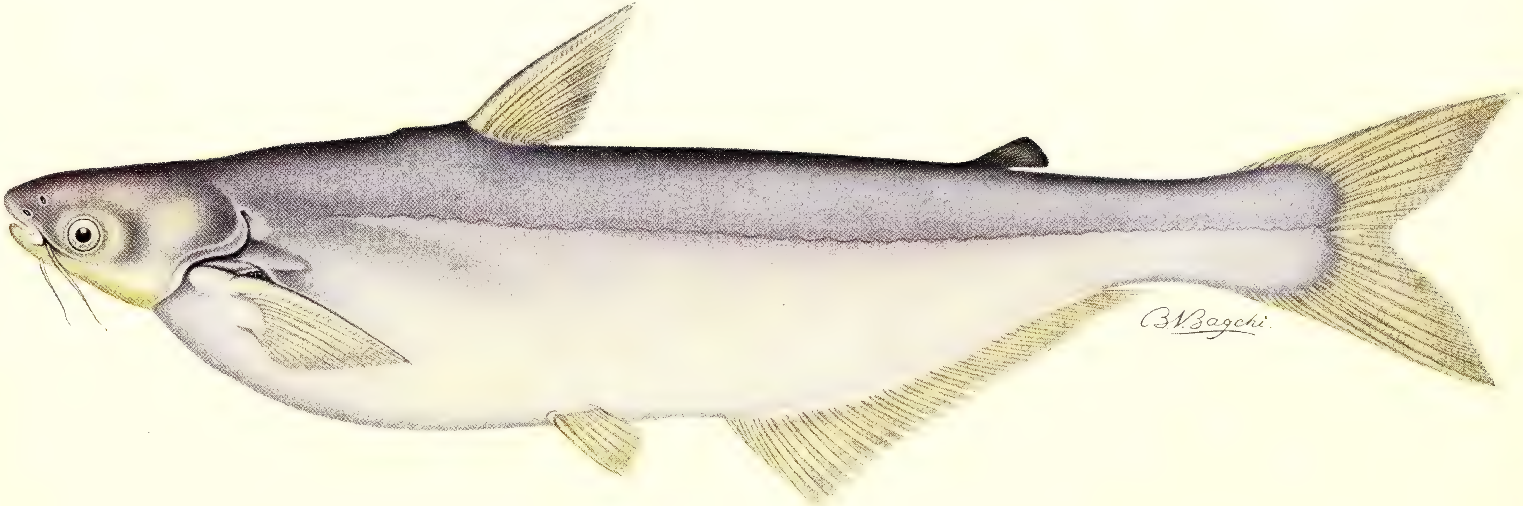
XXVII.—*Glyricidia maculata* as a Shade Tree for Tea. By J. Williams.......... 579

XXVIII.—General Flowering of *Strobilanthes* in South India. By J. Williams.......... 580

XXIX.—A Fasciated Inflorescence in a Banana. By K. C. Jacob, L.AG., F.L.S. (*With a photo*).......... 581

XXX.—A Natural History Tale. By R. C. Morris.......... 581

PROCEEDINGS—BOMBAY NATURAL HISTORY SOCIETY.......... 582



THE PUNGAS CATFISH

Pangasius pangasius (Hamilton).

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THE GAME FISHES OF INDIA.[1]

BY

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Assistant Superintendent, Zoological Survey of India, Calcutta.

(*With one plate and four text-figures*).

Continued from page 147 *of Vol.* xl.

V.—The Pungas Catfish.

Pangasius pangasius (Hamilton).

Contents.

	PAGE
Introduction	355
Nomenclature and Systematic Position	356
Synonymy and Description	362
Bionomics and Fishing Notes	365
Acknowledgments	366
List of References	366
Explanation of Plate	366

Introduction.

In the preceding article (8)[2] attention was directed to certain large Catfishes which are popularly known as 'Freshwater Sharks'. Of these *Pangasius pangasius* (Ham.) is perhaps the least destructive to fisheries; it is a foul feeder and consumes considerable quantities of mud and decaying animal and vegetable matter from the bottom of estuaries and lower portions of large rivers where it lives. On account of its foul habits and estuarine habitat it is not a favoured species with the anglers, and has received very little attention from the writers of books on angling in India. Thomas (**12**), however, makes a passing reference to it in *Rod in India.* It is a valuable food fish and grows to a size of about 4 feet or more. During dry months large quantities of this fish are imported into Calcutta from the neighbouring estuarine creeks, especially the Matlah at Port Canning, and command a ready sale. Very little is known about the bionomics of the species and much less about suitable tackle and appliances for catching the fish with rod and line. In the present article, therefore, I shall mainly confine myself to the scientific treatment of the species and the allied forms.

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[2] Numerals in thick type within brackets refer to the serial numbers of the various publications listed in the bibliography at the end of the paper.

NOMENCLATURE AND SYSTEMATIC POSITION.

Hamilton (**5**) described the *Pungas* Catfish in his composite genus *Pimelodus* and characterised it as

> 'A *Pimelodus* with four tendrils; with the tail fin bifid; and with the prickles of the back fin and pectorals very little longer than the membrane.'

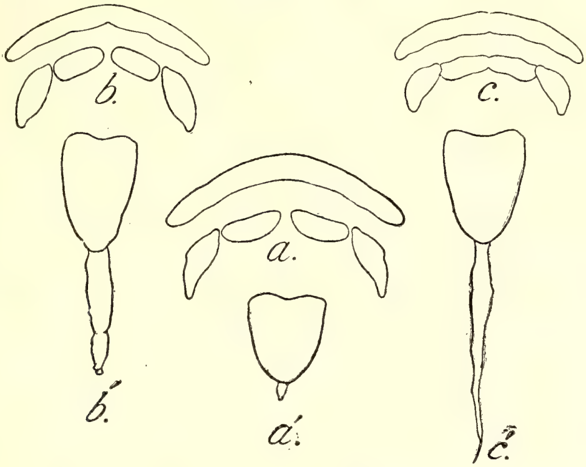
Cuvier and Valenciennes (**3**) found considerable difference between Hamilton's species and those referred to the American genus *Pimelodus.* Consequently they proposed a new genus *Pangasius* for its reception and observed that:—

> 'Le Bengale a aussi des siluroïdes à casque peu chagriné, et à quatre barbillons; mais leurs barbillons sont beaucoup plus courts qu' à ceux d' Amérique. Les rayons de leurs nageoires ne se prolongent pas, et, ce qui est plus important, ils ont dix rayons aux ouïes. Cette considération me force à les séparer des précédens, et montre l' affinité que ces espèces ont avec les platystomes.'

Cuvier and Valenciennes re-christened the species *Pangasius buchanani*, but, in accordance with the International Rules of Zoological Nomenclature, the specific name cannot be changed except under very special circumstances. The correct scientific designation of the species should, therefore, be *Pangasius pangasius* (Hamilton).

Though in India proper the genus *Pangasius* is represented by a single species, *P. pangasius* (Ham.), several species have been described from the Malay Archipelago, Siam and Indo-China. The genus is thus essentially a Far Eastern genus and India forms the western limit of its distribution. Some of the Malayan species, now included in *Pangasius,* were assigned to different genera, *Pseudopangasius* 1862, and *Neopangasius* 1904, by Bleeker (**1**) and Popta (**10**) respectively. Both the genera were erected on differences in the nature of the vomerine and palatine bands of teeth, but as these structures vary considerably, even in the individuals of the same species, both *Pseudopangasius* and *Neopangasius* are now regarded as synonyms of *Pangasius.*

In separating the Indo-Australian species of *Pangasius* Weber and de Beaufort (**13**) have attached great importance to the bands of teeth on the palate. I have found that in young specimens of *P. pangasius* (text-fig. 1a), about 78 mm. in standard length, the vomerine and the palatine bands are quite distinct, and, as a rule, the former are separated from each other by a considerable distance.

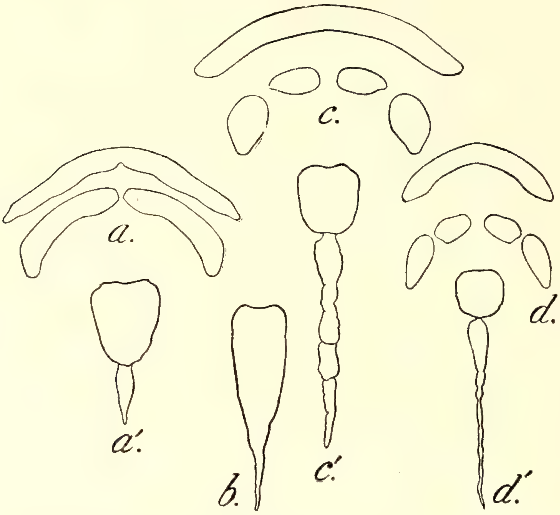


Text-fig. 1.—Upper dentition and air-bladder of 3 specimens of *Pangasius pangasius* (Hamilton), showing variation in form with growth. *a.,a'*. From a specimen 78 mm. in length without caudal; dentition ×3¼, air-bladder Nat. size; *b.,b'*. From a specimen 187 mm. in length without caudal: dentition ×1½, air-bladder ×½; *c.,c'*. From a specimen 207 mm. in length without caudal: dentition ×1⅛, air-bladder ×½.

In some examples (text-fig. 1*b*), up to about 187 mm. in length, the tooth-bands are still distinct, but in older specimens the bands become united. In some cases the bands are indistinguishably mixed up, whereas in other cases the boundaries of the various bands can still be discerned. *P. pangasius* is a very specialised member of the genus, and in its development probably passes through some of the primitive stages of growth of dentition in *Pangasius*. In this connection I have studied the dentition of certain Siamese species represented in the collection of the Zoological Survey of India.

In *P. hypophthalmus* (Sauvage), the maxillary teeth are poorly developed or totally absent and those usually present on the palate are always absent. This type of dentition is generally associated with the fishes of the genus *Helicophagus*. In *P. larnaudii* Bocourt (text-fig. 2*a*) the vomerine and the palatine teeth of each side are united, but the two bands thus formed are separated in the middle. In *P. micronema* Bleeker (text-fig. 2*c*) the four patches of teeth on the palate are quite distinct; while in *P. siamensis* Steindachner (text-fig. 2*d*), the tooth-bands, though distinct, are greatly approximated.

The simplicity in the form and structure of the air-bladder in *Pangasius* seems to be correlated with the simplicity of dentition. In *P. hypophthalmus* (text-fig. 2*b'*), the air-bladder consists of a bag-like structure which tapers considerably towards the posterior end. In *P. larnaudii* (text-fig. 2*a'*), the bladder is divided into an anterior and a posterior chamber; the former being much the larger of the two. In *P. micronema* (text-fig. 2*c'*), the anterior chamber is considerably reduced, while the posterior chamber is elongated, narrow, and subdivided into several chambers. In *P. siamensis* (text-fig. 2*d'*), the condition of the bladder is similar to that in *P. micronema*, but is accentuated still further. In the development of *P. pangasius* we find that the air-bladder is of a primitive type in young specimens (text-fig. 1*a'*), but with growth the anterior chamber becomes considerably reduced while the posterior chamber becomes narrow and elongated (text-figs. 1*b'* and 1 *c'*). I have explained elsewhere (**7**) the causes that are probably responsible for a change in the form and structure of the air-bladder; but it may suffice to mention here that with the compression of body and an increase in the area of the tail region the internal organs are greatly squeezed for want of space. Of the visceral organs, perhaps the air-bladder is the least important in the economy of nature and for this reason it is gradually squeezed out of the body cavity as the demand for space by organs like the liver and the kidney increases.



Text-fig. 2.—Upper dentition and air-bladder of certain species of *Pangasius* Cuv. and Val. from Siam.

a.,a'. Pangasius larnaudii Bocourt, length of specimen without caudal 150 mm. : dentition ×1½, air-bladder ×½; *b'. Pangasius hypophthalmus* (Sauvage), length of specimen without caudal 143 mm. : dentition absent, air-bladder ×½; *c.,c'. Pangasius micronema* Bleeker, length of specimen without caudal 154 mm. : dentition ×3, air-bladder ×½; *d.,d'. Pangasius siamensis* Steindachner, length of specimen without caudal 126 mm.; dentition ×3, air-bladder ×½.

The air-bladder of *P. pangasius* has received considerable attention; it was described for the first time by Taylor (**11**) as follows:—

> 'The *P. pangasius* has its air-bladder composed of four or more portions, extending in a line from opposite the pectoral fins, to near the end of the

> tail. The first is generally oval, the second pyramidal, and the two last, which run between the caudal portions of the lateral muscles, approach to a cylindrical shape. The numerous septa on its internal surface descend from above downwards in the first portion; in the second, they run in a transverse direction; and in the posterior ones, form a number of irregular cells.'

As will be clear from the above this type of bladder is characteristic of large specimens over a foot in length. After Taylor, Day (4) described the air-bladder of the species as follows:—

> 'Air-vessel large, extensive, and divided into three portions. The anterior is somewhat heart-shaped, considerably the largest, and extends from the commencement of the vertebral column to nearly opposite the posterior extremity of the pectoral fin. Its remaining portions are narrow, compressed, and continued to opposite the middle of the anal fin, amongst the muscles covering the haemal spines. It then becomes narrow and reduplicated on itself for a short distance. On removing the front wall of its first and largest portion, its interior is seen to consist of two pear-shaped cavities, the bases of which are inferior and lateral, whilst they coalesce anteriorly; the whole of the posterior half of this portion is cellular; and so is the small intermediate space between the two uncelled pyriform portions. The two posterior divisions of the air-vessel have valvular shaped folds, partially subdividing its anterior.'

Day's description is somewhat different from that of Taylor and it seems that his account is based on a smaller specimen than that examined by Taylor. Bridge and Haddon (2) also gave an account of the air-bladder of *P. pangasius*, but they were certainly dealing with a much smaller specimen than the ones examined either by Taylor or Day. They described the air-bladder as follows:—

> 'The air-bladder consists of an anterior portion, which is broad in front and oval behind, and corresponds to the whole of the normal bladder, and also of a contracted tubular part extending backwards in the substance of the kidney to within about half-an-inch of the anus. The anterior portion is divided internally into a short but broad anterior chamber, and two relatively large lateral compartments by the usual primary transverse and longitudinal septa. The posterior section of the bladder is a simple tubular cæcum, communicating anteriorly with both the lateral chambers but terminating blindly behind.'

Bridge and Haddon also referred to the discrepancies in the accounts of Taylor and Day, and remarked:

> 'As regards the subdivision of the bladder, the two accounts are neither reconcilable with each other, nor with the description given above by us, and assuming that the specimens examined by Day and Taylor were really examples of *P. buchanani*, we can suggest no explanation of the discrepancy. Our own specimen was one from Dr. Day's collection of East Indian Siluroids and had been named by him *P. buchanani*, and we may also add that its characters agreed in almost every detail with the description of this species in the *British Museum Catalogue of Fishes* (vol. v, p. 62). It will be noticed, however, that both Taylor and Day agree as to the extension of the air-bladder into the caudal muscles, which was certainly not the case in the specimen examined by us.'

The form and structure of the air-bladder in specimens of different sizes (*vide supra*, p. 357) clearly indicated to me that Taylor, Day, and Bridge and Haddon were dealing with the same species, and that the discrepancies in their accounts were presumably due to the specimens examined by them respectively being of different sizes. With a view to elucidate the problem I requested Mr. K. K. Nair (9) to make a detailed study of the changes in the internal structure of the air-bladder of *P. pangasius* during growth.

His results fully bear out the conclusions I had arrived at on a superficial examination of the air-bladder in this species.

Besides *Pangasius pangasius* (=*P. buchanani*) Bridge and Haddon have described the structure of the air-bladder in *P. djambal*, *P. macronema*, *P. micronema* and *P. juaro*. The variations noted by them are as follows :—

> 'The air-bladder of *P. djambal* consists of an anterior portion subdivided in the usual way into an anterior and two lateral compartments, and also of a posterior cæcal appendage. The latter is not tubular, as in *P. buchanani*, but has the shape of an elongated, flattened, oval structure, and extends nearly to the hinder extremity of the abdominal cavity, being separated from the rest of the bladder anteriorly by a deep constriction; from its posterior end a small cæcal protuberance is given off, which is less than half an inch in length, and gradually tapers to a point near the anus.'

P. djambal is now considered as a synonym of *P. pangasius*, and it is significant to note that the above description of its air-bladder corresponds with the structure of the same organ in a specimen of *P. pangasius*, 207 mm. in length without the caudal (text-fig. 1c'). Day's description of the bladder of *P. pangasius* more or less agrees with Bridge and Haddon's description of the bladder of *P. djambal*. Another point worth noticing is that Bridge and Haddon found the walls of the air-bladder of *P. djambal* much thicker than in the case of any other species of *Pangasius* examined by them.

> The air-bladder of *P. macronema* 'has thin walls, and consists of an anterior and somewhat rounded portion, which includes the anterior and two lateral compartments, and in addition also, a posterior much flattened, leaf-like cæcum connected with the foregoing by a short tubular stalk.'
>
> In *P. micronema* 'The air-bladder is broadly ovate in shape but rendered slightly bilobed in front through the existence of a deep median notch in its anterior wall. Relatively to the lateral compartments the anterior chamber is very small, and there is no posterior cæcal appendage. The walls of the bladder are extremely thin.'

Bridge and Haddon noted that this species is remarkable in being 'without a trace of the oval plate so characteristic of other species of *Pangasius*.' Thus it is not provided with the so-called 'elastic-spring mechanism', and the transverse process of the 4th vertebra, both in shape and in the support which it affords to the post-temporal and pectoral girdle, conforms to the normal condition in the great majority of the Siluroid fishes.

It is abundantly clear from the above that the air-bladder of *Pangasius* is a very variable structure and that in young individuals and less specialised forms the so-called 'elastic-spring mechanism' may be absent altogether. The last structure has been regarded by some authorities as of sufficient importance to separate *Pangasius* from the rest of the Schilbeidae into a separate family, but this is not justified on morphological grounds.

The genus *Pangasius* may now be defined as follows :—

The body is elongated and compressed. The head and body are generally covered with soft skin; the head exceptionally granulated. The head is of moderate size; the snout is more or less prominent, rounded or bluntly pointed. The mouth is sub-terminal, horizontal or slightly ascending. The lips are thickened near the angles and are continuous; the post-labial groove is widely interrupted. The nostrils are wide apart; the anterior ones are wide, look forwards and are situated along the front border of the snout; the posterior nostrils are provided with a lip anteriorly and are situated at some distance behind the anterior nostrils. The eyes have free orbital margins, are situated behind the corner of the mouth and generally a part of the eye is below a horizontal through the corner of the mouth. There are four short barbels; one pair maxillary and one pair mandibular. The maxillary barbels originate from the anterior ends of slits which commence above or behind the angle of the mouth and are continued below the eyes. The mandibular barbels originate considerably behind the tip of the lower jaw. The teeth are villiform; those in the jaws form curved bands. The vomerine and palatine teeth are in four patches which may be separate or variously united. In certain species the dentition is poorly developed (*vide supra*, p. 357). The dorsal fin is well developed; it is provided with a strong denticulated spine, which is preceded by another short and broad spine, and 6 to 7 rays; the anterior soft rays may be filiform. The adipose fin is small. The anal fin is elongate and provided with 28 to 40 rays. There is a considerable space between the anal and the caudal fins. The pelvics are 6-rayed. The pectorals possess strong, denticulated spines. The caudal fin is deeply forked. The gill-openings are wide; the gill-membranes are deeply notched, united, and free from isthmus. The branchiostegal rays vary from 7 to 11. The air-bladder is large and lies free in the abdominal cavity; it consists of two parts, a large anterior portion, which is broad in front and oval behind, and a small tubular part which extends backwards into the kidneys (for variations in the form and structure of the air-bladder, see *supra*, pp. 357-360).

Genotype :—*Pangasius buchanani* Cuv. & Val. 1840 (=*Pimelodus pangasius* Hamilton 1822).

Distribution:—Indo-China, Siam, Malay Peninsula and Archipelago, Burma, and India.

Relationships :—*Pangasius* formed the type of Bleeker's (**1**) group *Pangasii*, but with regard to its present-day systematic position there are two current views among the leading ichthyologists. Weber and de Beaufort (**13**) follow Bleeker and assign *Pangasius, Helicophagus, Lais* and *Pseudeutropius* to the family Pangasiidae which they characterise by the possession of a pungent dorsal spine, forked caudal fin, long anal with 28-40 rays, small mouth, free orbital margin, and a small adipose fin. Thus restricted, the family cannot include forms like *Ailia, Eutropiichthys,* etc. Regan (*Ann. Mag. Nat. Hist.*, (8) viii, p. 567, 1911) and Jordan (*Classification of Fishes*, p. 149, 1923) have included a large number of genera in the Schilbeidae but have excluded *Pangasius* from it for which they propose a separate monotypic family Pangasiidae. According to Regan the following are the salient features of the family:

> 'The Indian genus *Pangasius* differs from the Bagridae externally in the long anal fin, with 28 to 40 rays; maxillary and one pair of mandibulary barbels are present, but no nasal barbels. The skeleton is very similar to that of generalized Bagridae, differing only in the development of an elastic

> spring mechanism, the anterior rami of the parapophyses of the fourth vertebra being expanded distally to form a pair of oval plates inserted in the anterior wall of the air-bladder, but free from the supra-cleithrum. The air-bladder consists of an anterior division, corresponding to a normal bladder, and of posterior tubular cæcum. Vertebrae $15+29$.'

From Bridge and Haddon's account of the air-bladder and associated skeletal elements of certain species of *Pangasius* (*vide supra*, p. 360) it is clear that the so-called 'elastic-spring mechanism' is liable to considerable variation and that in some species of the genus it may be absent altogether. My work bears this out very fully and I see no justification for separating *Pangasius* from the remaining Schilbeid genera.

In another place I (**6**) briefly discussed the relationships of *Pangasius* to the other genera of the Schilbeidae and indicated that it probably evolved from *Pangasianodon*-like ancestors and in its turn gave rise to *Platytropius* Hora in Siam and to *Proeutropiichthys* Hora in India and Burma.

Synonymy and Description.

Pangasius pangasius (Hamilton).

1822. *Pimelodus pangasius*, Hamilton, *Fish. Ganges*, pp. 163, 376, pl. xxxiii, fig. 52.
1830. *Pimelodus pangasius*, Taylor, *Gleanings in Science*, p. 171 (Air-bladder).
1840. *Pangasius buchanani*, Cuvier & Valenciennes, *Hist. Nat. Poiss.*, xv, p. 45, pl. ccccxxv.
1846. *Pangasius djambal*, Bleeker, *Nat. Geneesk. Arch. Ned. Ind.* (2), iii, p. 290.
1853. *Pangasius buchanani*, Bleeker, *Verh. Bat. Gen.*, xxv, p. 118.
1858. *Pangasius buchanani*, Blyth, *Proc. As. Soc. Bengal*, p. 286.
1862. *Pangasius djambal*, Bleeker, *Atl. Ichth.*, ii, p. 73, pl. vii.
1863. *Pangasius buchanani*, Bleeker, *Ned. Tijdschr. Dierk.*, i, p. 107.
1864. *Pangasius buchanani*, Günther, *Cat. Fish. Brit. Mus.*, v, p. 62.
1864. *Pangasius djambal*, Günther, *Cat. Fish. Brit. Mus.*, v, p. 62.
1871. *Pangasius buchanani*, Day, *Prov. Zool. Soc. London*, p. 709.
1873. *Pangasius buchanani*, Day, *Freshw. Fish Fisheries India and Burma*, p. 264.
1877. *Pangasius buchanani*, Day, *Fish. India*, p. 470, pl. cviii, fig. 5.
1877. *Pangasius buchanani*, Beavan, *Freshw. Fish. India*, p. 135.
1889. *Pangasius buchanani*, Day, *Faun. Brit. Ind. Fish.*, i, p. 142, fig. 61.
1890. *Pangasius buchanani*, Vinciguerra, *Ann. Mus. Civ. Stor. Nat. Genova* (2) ix, p. 211.
1893. *Pangasius buchanani*, Bridge and Haddon, *Phil. Trans. Roy. Soc. London* (B), clxxxiv, pp. 214-219 (Air-bladder).
1907. *Pangasius buchanani*, Lloyd, *Rec. Ind. Mus.*, i, p. 222.
1913. *Pangasius pangasius*, Weber and de Beaufort, *Fish. Indo-Austral. Archipel.*, ii, p. 256.
1937. *Pangasius pangasius*, Nair, *Rec. Ind. Mus.*, xxxix, pp. 117-124 (Air-bladder).

Vernacular names:—*Pangas* (Goalpara): *Pangsa* (Nathpur); *Pungas* or *Pungwas* (Bengal); *Jellum* (Orissa); *Coola Kellette* (Tamil); *Nga dam* (Burma); *Nga tan* (Akyab).

B.9-10; D.2/6-7; A.30-34; P.1/12-13; V.6[1]; C.19.

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[1] In his list of the fishes of the Purnea (Purniah) District, Buchanan remarks about the *Pangsa* of the Kusi that 'the only specimen that I was able to procure had no abdominal fins.' The absence of one or both the pelvic fins among fishes is not an unusual occurrence.

In general appearance, *Pangasius pangasius* is not unlike *Silonia silondia*, but can be readily distinguished by the absence of the caniniform teeth in the jaws, and by the presence of two pairs of fairly well-marked barbels. The length of the head is contained from 3.5 to 4.8 times and the depth of the body from 4 to 5 times in the standard length. The head is more or less granulated on the dorsal surface. The snout is slightly prominent and obtusely rounded. The head is provided with a long, narrow, median fontanel. The occipital process is more than twice as long as broad at the base, and reaches to the base of the anterior, short dorsal spine. The eyes are situated partly on the lower surface of the head and almost in the anterior half of the head. The interorbital space is flat, and is slightly less than the length of the head excluding snout. The diameter of the eye is contained from 3 to 5 times in the length of the head, from 1 to 2 times in the length of the snout and from 1.4 to 3 times in the interorbital width. The mouth is inferior, lunate, and almost as wide as the length of the postorbital part of the head. The upper jaw is partly exposed. Generally the maxillary barbels reach to the base of the pectoral spine, and the mandibular barbels are equal to about half the length of the head. The teeth are small and villiform; those on the palate form a lunate or semicircular band composed of 4 patches which may be variously joined together. In fully grown specimens vomerine teeth form an oblong, quadrangular patch more than twice as broad as long. The dorsal spine is moderately strong; it is almost as long as the head behind the angle of the mouth, is strongly serrated along the posterior border, and finely serrated anteriorly. The pectoral spine is stronger than that of the dorsal fin, and is strongly denticulated internally. The caudal fin is deeply forked.

According to Hamilton, 'The *colour* above is dusky green, and below white, with a purple gloss on the sides. The fins are whitish.' In specimens freshly taken out of water, the back is yellowish green which fades into bluish mauve above and light mauve on the sides. The lower half of the body is silvery white with a reddish tinge anteriorly. The sides of the head are golden yellow, while the fins are light reddish yellow.

Distribution and variation:—*Pangasius pangasius* grows to upwards of 4 feet in length and inhabits large rivers and estuaries. Hamilton probably became familiar with this species while stationed at Puttahaut and Baruipur in Bengal. For this reason he gives its habitat as 'estuaries of Bengal'. The species is now known from India, Burma, Siam, Malay Peninsula, and Java.

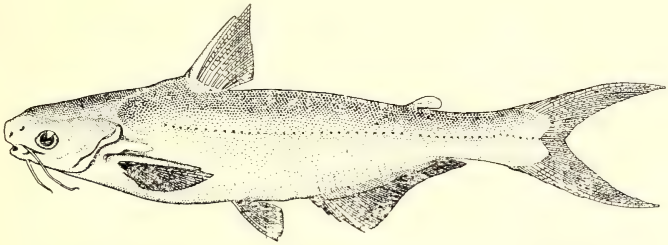
The eye is more rounded in the Burmese specimens, which also possess proportionately longer barbels. The barbels are generally longer in young individuals. In a specimen from Bangkok, the first rays of the pectoral and anal fins are filamentous. Body proportions show considerable variation with the growth of the fish.

In the collection of the Madras Museum there are two specimens from the Bhavani river in which the eyes are proportionately much larger, and correspondingly the snout and the interorbital space are shorter. The barbels are also shorter. The precise locality of these specimens is not known, but from the characters enumerated above

Measurements in millimetres

	Sunderbunds		Calcutta			Akyab	Rangoon	Bangkok		Bhavani River	
Total length excluding caudal	93·0	116·0	150·0	233·0	515·0	220·0	240·0	95·0	122·0	152·0	164·0
Length of head	21·0	27·0	34·0	53·0	100·0	49·0	51·0	25·0	35·0	33·0	37·0
Width of head	18·0	22·5	28·0	40·0	77·0	36·0	43·0	18·5	28·0	24·0	30·0
Width of body	12·5	17·0	22·0	26·0	61·0	29·0	36·0	15·0	22·0	20·0	24·0
Height of body	19·0	25·0	33·0	44·0	128·0	50·0	50·0	24·0	30·0	31·0	39·0
Diameter of eye	6·0	7·0	9·0	13·0	20·0	11·0	11·0	7·0	9·0	11·0	12·0
Length of snout	9·0	11·0	13·0	19·0	40·0	19·0	22·0	10·0	14·0	10·0	12·0
Interorbital width	11·0	15·0	17·0	30·0	60·0	28·0	32·0	12·0	20·5	15·0	19·0
Length of pectoral spine ...	18·0	23·0	28·0	40·0	85·0	43·0	40·0	16·0	22·0	28·0	31·0
Length of dorsal spine ...	18·0	23·0	25·0	38·5	77·0	42·0	39·0	16·0	21·0	24·0	25·0
Length of maxillary barbel ...	21·0	24·0	26·0	29·0	46·0	22·0	46·0	18·0	19·0	20·0	29·0
Length of mandibular barbel.	17·0	21·0	22·0	27·0	32·0	damaged	37·0	12·0	13·0	14·0	17·0

they seem to have been obtained from clear waters, where larger eyes are probably of advantage. Owing to the paucity of the material from the Bhavani river it is not possible to elucidate the problem any further. The occurrence of the species so far inland is, however, of special interest.

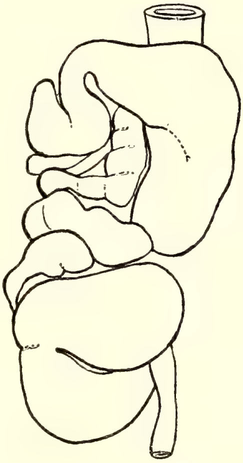


Text-fig. 3.—Lateral view of the large-eyed form of *Pangasius pangasius* (Hamilton) from the Bhavani river. × $\frac{2}{5}$.

Bionomics and Fishing Notes.

By all authorities *Pangasius pangasius* is regarded as a foul feeder. Hamilton (**5**) noted that 'It is eaten by all ranks of natives that use fish, but is not considered as of the best quality.' The alimentary canal is fairly long; the stomach is a large bag-shaped structure and the last portion of the canal is also wide and scale-like. It is probably one of the fishes that feed at night, and, being a bottom-feeder, can best be taken by paste baiting. Thomas (**12**) records having taken a *Pangwás* of 14 lbs. in this way.

Young specimens, about 70 mm. to 80 mm. in length, are brought to the Calcutta Markets in November-December for sale from the Matlah river. In the collection of the Indian Museum there are young specimens of *P. pangasius* collected from the Matlah river in December, 1916. No specimens of the species were found in the Calcutta Water-works at Pulta or in the river Hooghli above Calcutta in April, 1936. Examination of the catches of fish at Nawabgunge also showed that this species does not come up the river in fresh waters. From the evidence so far available it seems that *P. pangasius* is mainly an estuarine fish that breeds in the rainy season in the lower portions of the estuaries. Strictly freshwater specimens that I have examined are those collected in the Bhavani river and now preserved in the collectioon of the Madras Museum,



Text-fig. 4.—Alimentary canal of a small specimen, 85 mm. in length without caudal, of *Pangasius pangasius* (Hamilton). ×2.

ACKNOWLEDGMENTS.

The Bombay Natural History Society very kindly made a grant towards the cost of the illustrations, and for this I offer my sincere thanks to the authorities of the Society. Mr. K. S. Misra has helped me with the preparation of the table of measurements, and for this I am indebted to him. The illustrations were prepared by Babu B. Bagchi with his usual skill and care under my supervision.

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EXPLANATION OF PLATE.

Colour sketch of the lateral view of a specimen, 550 mm. in length without the caudal, of *Pangasius pangasius* (Hamilton) from the Calcutta Market.

THE BIRDS OF BOMBAY AND SALSETTE.

BY

SÁLIM ALI AND HUMAYUN ABDULALI.

PART V.

(*With one plate*).

(*Continued from p.* 173 *of this volume*).

The Indian Barn Owl : *Tyto alba javanica* (Gmelin).

Field identification : Size about that of the Jungle Crow. Upper plumage pale ashy-brown, finely stippled with black and white. There is a great deal of yellowish-brown about the shoulders and on the wings. Lower parts white, sometimes tinged with buff and usually spotted with dark brown. The white facial disc with the large forwardly directed eyes and the hooked nose-like tip of the bill set in the large round head give it a ludicrously human appearance. Singly, on cornices and under gables etc. of buildings, both ruined and inhabited —commonly in the heart of the city and in the suburbs. Flying about, ghost-like, from one building to another above the glare of the street lamps.

Specimens : *B.N.H.S.* : ♀ 2-4-08 Bandra ; ♂ 10-6-12 Bandra (Mr. Windgate) ; ♀ 15-4-09 Bombay Mint (T. P. Guidera) ; *St. Xavier's College* : 173 ♂ 1-3-34 Bombay City.

Noted : *City* : Khētwādi, Girgaum, Chowpāti, Malabār Hill, Fort, Colāba, Crawford Market, Byculla, Pydhowni, Parēl etc. *Salsette* : Trombay Church, Gōdhbunder, Andhēri.

Resident. Not uncommon. The Barn or Screech Owl is purely nocturnal in its habits. It is greatly inconvenienced by sunlight and retires into dark corners and hollows during the day, seldom stirring abroad till after dusk. If disturbed during daylight it blinks distractedly and is invariably set upon and mercilessly mobbed by crows. The narrow slits under the steel water tanks placed on buildings in the city offer admirable daytime retreats and nesting sites to the urban Screech Owl population. They share these with the local pigeons and live seemingly at peace with them.

The food of the Barn Owl consists mainly—almost exclusively—of rats and mice and it is thus a highly beneficial species to have about human habitations. Some years ago we found the ground below a niche—the nesting site of a pair of these owls—in the ruined Portuguese church on the hill at Trombay to be littered with innumerable skulls, jaw- and leg-bones of rats and mice. In its haunts in the City it is not improbable that it also takes a surreptitious toll of its next-door neighbours, the pigeon squabs, which it can procure with such ease.

Breeding : We have taken no nests in Bombay or Salsette, but a pair had their family under a water tank on a building at Chowpāti (behind Wilson College) during December 1925, whence emanated a ceaseless screeching and hissing of the most raucous and eerie sort all night. It is said to breed throughout the year except in the rainiest months—July and August—laying 4 to 7 roundish-oval white eggs.

The Short-eared Owl : *Asio flammeus flammeus* (Pontop.).

Field identification : Size the same as the last. Brown above with pale edges to the feathers making a sort of game bird pattern. White underneath streaked blackish, especially on throat and breast. Facial disc buffy-white finely streaked with black and surrounded by a ruff of dark brown feathers. The two short blunt dark coloured ear-like tufts above the bright lemon-yellow eyes make its identity unmistakable. In flight rufous in wings conspicuous. Singly, in scrub and grass country such as the dry mud-flats along our creeks.

Specimens: *B.N.H.S.*: ♀ 7-2-24 Andhēri (S. H. Prater); o? November 1890 Kūrla (J. M. Mason); *St. X. C.*: 164 ♀ 10-11-33 Jūhū (H.A.).

Noted: Gōdhbunder, Bassein.

A somewhat sparse though probably regular winter visitor. Latest date 18 April (1934). Usually seen perched on the ground at the base of some cactus or other bush. It does not appear to be inconvenienced by daylight and when flushed, flies well and often for long distances.

[The Brown Fish Owl: *Ketupa zeylonensis* ssp.?

Field identification: Size and appearance not unlike the next species, but with the legs unfeathered and covered with small rough scales instead.

H.A. has observed occasional examples about the mudflats and creeks near Andhēri which he thinks may be this species.]

The Indian Great Horned Owl: *Bubo bubo bengalensis* (Frankl.).

Field identification: Size that of the Pariah Kite. A dark brown owl, streaked and mottled with buff and black, with two conspicuous black aigrettes or 'horns' above the head. Not unlike the Fish Owl in general effect, but with the legs fully covered with fulvous feathers. Singly or pairs in ancient trees about villages and cultivation.

[Specimen: *St. X. C.*: 128 ♀ 16-10-33 Kihim (H.A.).]

Not noted in Salsette, but it undoubtedly occurs and presumably is resident. The specimen was procured just across the Harbour. Its stomach contained insect remains only.

This owl has a deep hollow resounding call *Bu—bo* usually audible after sunset.

The Eastern Scops Owl: *Otus scops pulchellus* (Pall.).

Specimens: *B.N.H.S.*: o? September 1891 Bombay; ♀ 26-10-25 Colāba, Bombay (S. H. Prater. Found perched on a hat-peg inside living room!).

The Striated Scops Owl: *Otus brucei* (Hume).

Specimen: *St. X. C.*: 201 o? 11-11-34 Andhēri. (H.A. Caught in a house during daytime. When annoyed, it made a sharp noise by clicking its mandibles together.)

Status? Uncommon.

The Southern Spotted Owlet: *Athene brama indica* (Frankl.).

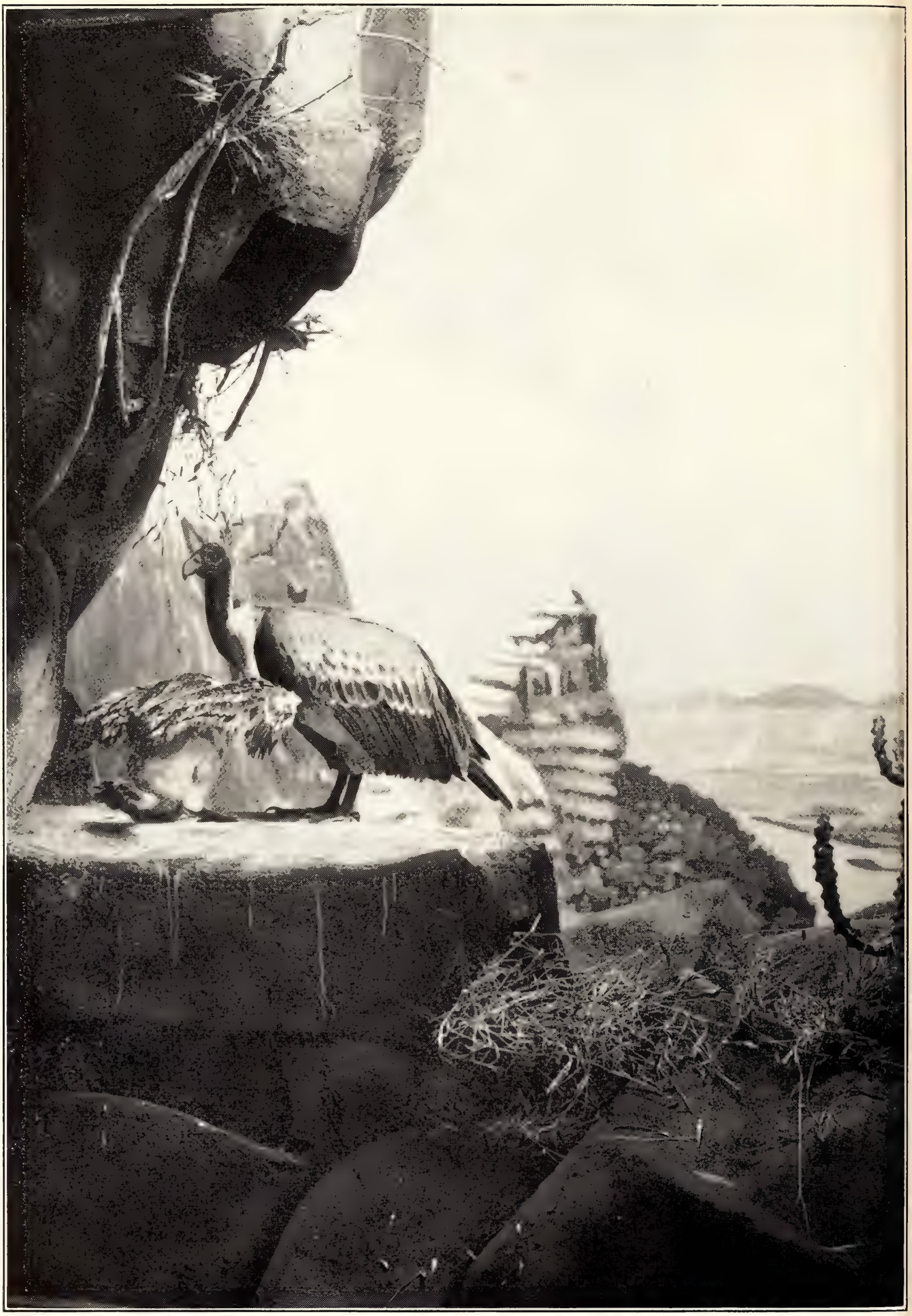
Mahrātti: *Pingla*.

Field identification: Size about that of the Myna but plumper, squatter and with a large round head seemingly fixed on without a neck. Greyish earthy-brown above with white spots and markings. Lower plumage whitish, more or less barred with brown. Typical large, round, forwardly directed eyes. Pairs, in large mango or tamarind trees near villages.

Specimens: *B.N.H.S.*: ♀ 16-1-08 Bombay (N. B. Kinnear); o? 16-3-25 Pāli Hill, Bandra (S.A.); o? 10-11-25 Bombay (Sir H. McNaughten). The above specimens seem to be somewhat intermediate between the races *brama* and *indica*, but on the whole are perhaps nearer the latter.

Noted: *City*: Government House Grounds, Wālkēshwar; Victoria Gardens, Byculla; Parēl. *Salsette*: Powāi Lake, Andhēri, Chembūr etc.

Resident. The Spotted Owlet is a familiar species in Salsette and a pair or so may commonly be found in occupation of holes and hollows in large mango, tamarind and similar trees growing in such large rambling compounds in the City as still exist, as well as about villages and homesteads in suburban areas. It is largely of crepuscular habits, not so much because daylight inconveniences it—since it is often abroad and even hunting in bright sunlight—but because of the persecution and swearing it is invariably subjected to by other birds as soon as it shows itself during the day. Pairs may be seen sitting huddled together on some shady branch. A tap on the trunk, or any noise underneath the tree, will immediately produce an enquiring little head at the entrance of a hollow. Often the bird will fly out and into a neighbouring branch, thence to bob and stare at the intruder in clownish fashion. At dusk these owlets may be seen perched upon fence posts, telegraph wires and the like, pouncing from time to time on some unwary mouse or cricket on the ground. They may sometimes be seen making ungainly sallies after winged ants and capturing them in their claws.



THE GRIFFON VULTURE [*Gyps fulvus* (Habligl.)] Nesting on the Cliffs at Mumbra, Thana Dist., Bombay. *From a Group in the Natural History Section, Prince of Wales' Museum.*

They are noisy birds and have a variety of harsh chattering and chuckles, two birds usually joining in a duet.

Breeding : We have seen eggs and young in Salsette during February, March and April. The eggs number 2 to 4 and are roundish-oval, white in colour. The nest—a pad of coir or similar fibres—is placed in holes in walls and natural hollows in tree trunks, etc. By the time the young have left it emits a ghastly stench !

The Jungle Owlet : *Glaucidium radiatum radiatum* (Tickell).

Field identification : Size and general effect as last, but dark brown above and conspicuously barred (not spotted) with pale rufous. Lower parts rufous and white, closely barred with blackish-brown. Singly, or pairs, in trees in wooded tracts.

Specimens : *B.N.H.S.* : o? 26-1-30 Vihār Lake environs (E. Lieberherr); *St. X. C.* : 61 ♀ 3-9-33 Jogēshwari Caves (H.A.).

Noted : Borivli, Powāi Lake environs.

Resident (presumably). Not uncommon in the jungly parts of Salsette. H.A. describes the call, which is not unpleasant, as 'a screech of 4 or 5 syllables ending with a sharp *whau-whap*'. When disturbed in daytime the bird utters an angry *qāoo*. This same note also usually precedes the call which may be uttered throughout the day, the bird not seeming to be particularly incommoded by sunlight.

Breeding : We can trace no records of nests or eggs from the immediate neighbourhood of Bombay and Salsette.

The Osprey : *Pandion haliaëtus* (Linn.).

Field identification : A typical bird of prey, slightly larger than the Pariah Kite. Dark brown above, white below streaked with dark brown. Head and neck white. A broad brown 'necklace' on upper breast conspicuous and a distinguishing feature. Usually singly, near the creeks and sea coast or our lakes, perched on fishing stakes or flying over the water with a peculiar rapid beat of its wing-tips, hovering with the poise of the Pied Kingfisher and hurling itself upon a fish near the surface with great spectacular effect.

Noted : Back Bay Reclamation, near Church Gate ; Vihār and Powāi Lakes. Also down the coast at Kihim, Alibāg, Rewdānda, Salāo etc.

Winter visitor. Latest date—exceptional—17 June. EHA (*C.B.B.* 28) saw one even as late as August and suspected that a few pairs may remain behind and rear their young on our coast. We have no evidence of the Osprey breeding in this latitude, however, but it is not unlikely that some young non-breeding individuals may stay with us all the year as is the case, for instance, with the Common Sandpiper.

The Black, or Pondicherry Vulture : *Sarcogyps calvus* (Scop.).

Field identification : Size about that of the Peacock without the train. Black, with the naked head and neck, 2 bare patches on either side of the crop, and legs deep red. There are also 2 patches of downy white feathers on the thighs which, coupled with the above characters, render its identification on the wing easy. Singly, or twos and threes, in every vulture assemblage at animal carcases.

Resident. Somewhat rare and in small numbers. In our experience it is usually a cowardly bird and by no means the King described. We have never seen any deference shown it by the other vulture species, but on the other hand it may usually be seen on the outskirts of the actual press of jostling feasters at a carcase biding patiently for a favourable opportunity to slink in and snatch a morsel.

We have as yet found no nests of this vulture in Salsette. It builds large stick platforms in trees.

The Indian Griffon Vulture : *Gyps fulvus fulvescens* Hume.

Field identification : Size as the last, with a longer naked blackish head and neck more or less covered with straggly down. General colouration varying shades of cinnamon brown, the pale edges to the feathers of upper parts producing a sort of game bird pattern. Short square tail and rectangular wings with the primaries spread out like fingers at the tips, are characteristic features of a vulture in flight.

Specimens: Adult (1-2-36) and juvenile (16-2-36) from Mumbra and Funnel Hill, Karnāla, exhibited in the Bird Gallery, Prince of Wales Museum, Bombay.

Resident. Common. In the City this Vulture may be seen in small numbers about the Parsi Tower of Silence, Malabār Hill. It is common in the suburbs and Salsette at every animal carcase on the countryside.

Breeding: There are no cliffs suitable for the nesting of the Griffon Vulture in Salsette, but at Mumbra and Karnāla Fort, on the adjoining mainland, they breed in some numbers occupying ledges on the steep rock faces of Funnel Hill and similar places. The nest is a large untidy structure of twigs and straw. A single egg is laid, white in colour sometimes sparsely and faintly blotched with reddish brown. Usually not much is left of the nest by the time the young, is fairly grown, possibly due to the restricted space on the ledge and the displacement caused by the constant shuffling about of the occupant. Between 1 and 16 February (36) all the nests in the colonies at Mumbra and Karnāla contained young.

The Long-billed Vulture: *Gyps indicus* ssp.

Field identification: Size as the last. When overhead, it is distinguishable from the commoner White-backed Vulture by the uniform—not contrasting—colouration of the underside of its wings and body. As compared with the Griffon, its general colour is a dirty earth-brown.

Resident. Fairly common. To be seen among every gathering of vultures at a carcase.

Breeding: On 4 November (1933—Kaneri) a bird was observed carrying a stick for its nest. On 1-2-36 H.A. discovered a few pairs with fairly bulky stick nests on inaccessible ledges of cliffs at Mumbra (near Thāna). Griffon Vultures were also nesting on these cliffs, but it was noted that the two species occupied different portions of the hill.

The Indian White-backed, or **Bengal Vulture**: *Pseudogyps bengalensis* (Gmelin).

Field identification: Size as the last. Dirty blackish-brown, with practically naked head and neck. The lower back is white and a distinguishing feature. In overhead flight, a conspicuous whitish band stretches along the underside of the open wings broken in the middle by the brown body of the bird.

Resident. Our commonest vulture. Numbers always present about the Parsi Tower of Silence on Malabār Hill, the slaughter-house at Bandra and quartering the heavens everywhere. As scavengers, vultures are of the greatest utility to man. The speed and thoroughness with which a company will dispose of the carcase of a bullock or other large animal left in the precincts of a village to befoul the air and breed pestilence, is remarkable.

Breeding: This vulture always builds its nests in large trees—Peepal, Banyan, Tamarind or on Palmyra or Cocoanut palms—25 to 40 feet up. The nests may commonly be seen about Borivli, Gōdhbunder, Chembūr and elsewhere in Salsette, often situated in or near a village. Frequently several nests may be in the same tree. They are large untidy platforms of sticks lined with green leaves. There is apparently no well-defined season though from October to March the nesting is most general. We have observed a bird pulling off green Casuarina twigs from a tree for its nest in May, and a pair mating on the 7th of that month. At that time some full-fledged young were also about with their parents. Only a single egg is laid, white in colour sometimes blotched with reddish-brown.

The Smaller White Scavenger Vulture or **Pharaoh's Chicken**: *Neophron percnopterus ginginianus* (Lath.).

Field identification: Size that of the Pariah Kite. Young birds are brown and not unlike the Kite in colouration. Adults are dirty white with black wing quills, and a naked yellow head and bill. In flight the wedge-shaped tail distinguishes it from Kites, Eagles and Vultures. Usually seen singly or in twos and threes, on the outskirts of villages, stalking along the ground with a high-stepping, waddling gait. EHA says 'It carries its body like a duck and steps like a recruit'—a very apt description.

Resident. Rather uncommon except about the mudflats near Kūrla and Dharāvi. At Bhamanvadi H.A. once observed over 50 of these birds circling up in the air at the same time.

It is a useful scavenger and will eat any refuse or offal it can come by, not excluding human ordure.

Breeding: We have not come across any nests in Salsette, but Brother Navarro of St. Xavier's College found one with eggs on an inaccessible ledge of rock on Mumbra Hill near Thāna—29 January (1936). Normally it breeds chiefly in March and April. The nest is a shabby accumulation of sticks, rags and rubbish of every description placed on ledges of cliffs, ruined buildings or in the main fork of large trees. The eggs, usually two, vary from white to pale brick-red in colour and are blotched with reddish-brown or blackish, rather thickly round the broad end.

[**The Shahin Falcon**: *Falco peregrinus peregrinus* Sund.

Field identification: Size about that of the Jungle Crow. Dark slaty and ashy-grey, above, white below with a pale ashy tinge, and barred from lower breast downwards with blackish. Conspicuous blackish cheek-stripes. Swift powerful flight on rapidly beating pointed wings. Singly, in more or less open country.

Specimen: *St. X. C.*: ♂ 25-10-33 Kihim (Alibāg Taluka, Kolāba Dist. H.A.).

Winter visitor. It is not uncommon along the coast, across the Harbour, during the cold weather when it must visit Salsette also. The stomach of the specimen contained remains of a Pied Crested Cuckoo. Another example shot at Alibāg in March contained fragments of a downy duckling, presumably lifted from the village.

We have no specimens of *Falco p. peregrinator*, the resident Indian form which probably also occurs in Salsette. This race is said to nest on ledges of steep cliffs from the Himalayas to Travancore, and a pair of large falcons observed by H.A. nesting near the top of the Funnel at Karnāla (25-2-34) were possibly these birds.]

The Laggar Falcon: *Falco jugger* J. E. Gray.

Field identification: Size slightly larger than the Pigeon. General effect similar to the Shahin but smaller size and brownish (not slaty) upper parts diagnostic. Usually singly or pairs about open country and thin jungle.

Specimens: *B.N.H.S.*: ♂ 8-2-06 Bombay (W. S. Millard); o? 1899 Colāba, Bombay (Capt. Piele).

Resident? Not common. EHA (*C.B.B.*, p. 24) mentions that many years ago a pair of these falcons had their headquarters, and perhaps their nest, at the University Tower. S.A. observed a pair about this same tower for several months early in 1925. According to EHA they feed largely on the pigeons that inhabit the city.

We have no record of their nesting in Salsette, though it is quite probable that they do so.

The Hobby: *Falco subbuteo* (*subbuteo* Linn.?).

Field identification: Size that of the Pigeon. In colouration and general effect a small replica of the Peregrine Falcon but with more rufous in the lower plumage.

Specimens: *B.N.H.S.*: ♀ 5-12-04 Bombay (J. D. Inverarity); ♀ 27-10-20 Kennery Islands (V. S. LaPersonne); *St. X. C.*: o? imm. 24-12-34 Andhēri (H.A.).

Winter visitor. Uncommon.

[**The Red-headed Merlin**: *Æsalon chiquera chiquera* (Dauden).

Field identification: Size about that of the Pigeon. The colour scheme of its upper parts is a reversal of that of the Kestrel. Crown, nape, sides of head and cheek stripes chestnut, back and rest of upper parts bluish-ashy. Lower parts white, barred posteriorly with blackish. Usually singly or pairs in open scrub country.

Specimen: *St. X. C.*: 146 ♀ 24-10-33 Kihim, Kolāba Dist. (H.A.).

Status? Rare. We have not come across the Merlin in Salsette.]

The European Kestrel: *Falco tinnunculus tinnunculus* Linn.

Field identification: Size about that of the Pigeon, with longer tail. Back and wings brick-red, with black wing-quills and grey head and tail. Underparts light buff spotted with brown. Singly, on grass and fallow land about cultivation. Often seen stationary in the air on hovering wings.

Specimens : *B.N.H.S.* : o? 8-12-25, o? 11-11-28 Kūrla (D. A. Baretto); *St. X. C.* : [127 ♀ 16-10-33 Chōndi, Alibāg Taluka, Kolāba Dist. (H.A.)]

Noted : Colāba Reclamation, Hindu Gymkhana Grounds, Mātūnga, Dānda, Andhēri, Chembūr, Gōdhbunder.

Winter visitor. The Kestrel is not abundant, but single birds are commonly met with during the cold weather. It frequents open grass country with light scrub and small bushes here and there, and fallow land on the outskirts of cultivation. It usually perches on a stone or small bush, or hovers in mid-air to spy out insects, lizards and mice on the ground. This hovering is the most characteristic habit of the species.

The more brightly coloured race, the Indian Kestrel (*F. t. objurgatus*) probably also occurs in our area, but it is difficult to differentiate it with certainty from the European bird in the field. We have observed it about the Lingmāla Falls near Panchgani (W. Ghats, 4,400 ft.) on 11 June. A pair about some cliffs at Mahāblēshwar (Chinaman's Falls), at the end of May 1931, certainly looked as if they had their nest on a ledge.

The Eastern Steppe-Eagle : *Aquila nipalensis nipalensis* (Hodgs.).

Specimens : P.W. Museum, Bombay : ♂ ♀ 18-12-23 Andhēri (S. H. Prater).

Winter visitor or straggler? Rare. The specimens provide the only instance of their occurring in our neighbourhood.

The Booted Eagle : *Hieraëtus pennatus* (Gmelin).

In the B.N.H.S. Collection there are two specimens, both female, obtained by Mr. N. B. Kinnear at Andhēri on 15-12-08 and 15-2-09 respectively. We have not knowledgably come across this eagle in Salsette.

The Indian Black Eagle : *Ictinaëtus malayensis perniger* Hodgs.

We have doubtfully observed this eagle on a few occasions soaring over forest at Jogēshwari, Gōdhbunder and Tūlsi Lake in Salsette, and on Kankēshwar Hill across the Harbour in Kolāba Dist.—all between October and March. Mr. C. McCann described to H.A. an eagle which attacked his poultry at Andhēri (2-2-36) that could hardly have been any but this species. Confirmation, however, is necessary.

The Short-toed Eagle : *Circaëtus ferox* (Gmelin).

Field identification : Larger than the Pariah Kite. Large greyish-brown head. General plumage earthy-brown. Lower parts from breast downwards white barred with pale brown. Bare reticulated tarsi.

Specimens : *B.N.H.S.* : [♀ 12-2-00 Kalyan (J. Brand)] ; o? 1920 Thāna (W. R. Clarke) ; o? 30-11-25 Kūrla (D. A. Baretto). *St. X. C.* : o?—Trombay.

Status? Uncommon. Its food consists largely of snakes.

The Crested Serpent Eagle : *Spilornis cheela* subsp.?

Field identification : Rather larger than the Pariah Kite. A dark brown eagle with full round black crest and brownish lower parts that are spotted or finely barred with black and white. Usually singly about forest.

Status? Pairs of these eagles may sometimes be seen in the forested portions of north Salsette and in the neighbourhood of the lakes, soaring in circles high above and uttering their penetrating high-pitched call of 3 notes *Kek-kek-kee,* the final *kee* much prolonged.

The White-eyed Buzzard-Eagle : *Butastur teesa* (Frankl.).

Field identification : Somewhat smaller than the Pariah Kite, greyish-brown in colour with white throat, brown and white underparts, 2 cheek-stripes and orange-yellow cere. Eye white or pale yellow, conspicuous at short range. Whitish-grey patches on shoulder of wing prominent. Singly, in open deciduous jungle and by cultivation and grassland.

Specimens : *B.N.H.S.* : ♀ 29-12-23 (S. H. Prater) ; ♀ 11-109 Andhēri (N. B. Kinnear) ; o? 13-11-25 Kūrla (D. A. Baretto) ; o? 11-3-11 Bombay.

Uncommon. Resident, presumably, though strangely enough we have no record between about April and November. Its food consists principally of lizards, mice, and large insects such as locusts and grasshoppers. It keeps a lookout for its prey from posts or dry trees and pounces upon it.

We are not aware of its nesting in Salsette or the immediate neighbourhood.

The White-bellied Sea-Eagle : *Haliaëtus leucogaster* (Gmel.).

Field identification : A large bird of prey somewhat smaller than the Vulture, slaty-grey above white below. Broad blackish edging of wings and broad white tip of darkish tail diagnostic in overhead flight. The head is also white. In sailing flight, the wings are held raised above the body in an open V. Usually pairs, along the sea-coast.

Resident. In Salsette, the White-bellied Sea-Eagle has only been observed by us at the Gōdhbunder Creek and Tūlsi Lake, but across the Harbour—Alibāg etc.—and down the Konkan Coast it is fairly common. Its call is a loud duck-like *Kak-Kak-Kak* uttered in flight as well as from a perch. From this call, as EHA has pointed out, the bird gets its local name of *Kakan*. Its food consists of fish and sea-snakes captured near the surface of the water.

Breeding : The nest is an enormous platform of sticks usually built in tall trees such as Casuarinas near the sea-shore. Old nests are repaired, added to and used year after year. We know one at Kihim that has been used successively for over 25 years to our personal knowledge and for at least 20 more according to reliable local testimony. It is said to have already been in existence long before our informant came to live in the neighbourhood. The birds remain in the vicinity of the nest throughout the year, even in the non-breeding season, and may frequently be seen carrying a freshly caught fish to the empty nest to be eaten there. It would be interesting to discover—only possible by the ringing method—whether and for how long the same owners use a nest, how possession of the nest is transferred and what becomes of the young when they grow up, since the number of these eagles in any given locality appears to remain fairly constant.

The eggs, usually two, are laid in October or November.

The Brahminy Kite : *Haliastur indus* (Bodd.).

Field identification : Size that of the Pariah Kite. Tail rounded, not forked. Head, neck and underparts white, upper parts chestnut-red. Young birds brown like the Pariah Kite but the shape of the tail is always a dependable distinguishing feature. Usually near water—Harbour, creeks and water-logged areas.

Specimens : *B.N.H.S.* : ♂ 22-7-25, 27-7-25 Colāba, Bombay (C. McCann); *St. X. C.* : 42 ♂ 19-7-33 Andhēri (H.A.).

Noted : Mahāluxmi, Pherozeshah Mehta Gardens (Malabār Hill), Pāli Hill, Khār, Bandra, Kūrla, Sion, Andhēri etc.

Resident. Not uncommon. Local movements are particularly in evidence during the monsoon when these kites move inland owing to the prospect of food offered by the water-logging of low-lying areas. Their diet consists of any offal or garbage that can be come by, but they prefer to pick this off the surface of water. Accordingly, the Bombay docks are admirably suited to their requirements and here they get a constant supply of food floating about in the form of rubbish of every description thrown overboard from the ships. During the monsoon, land crabs in inundated country supply a welcome change of fare and are much sought after. Lizards and frogs are also eaten.

Its call is a rather harsh wheezy squeal—like that of a Pariah Kite suffering from acute hoarse throat!

Breeding : We have observed a nest nearing completion in a Casuarina tree—*ca* 70 feet up—on the sea-shore at Kihim on 1 April (1926), both owners working. Another nest in the same neighbourhood contained a single fledgling on 25 May (1936). A nest in a large Peepal at Chembūr had 2 downy young in it at the end of May. Lt. H. E. Barnes (*J.B.N.H.S.*, iii, 217) found a nest in Bombay on 2 February.

The nest is the usual largish platform of twigs. Normally 2 eggs are laid, greyish-white in colour feebly spotted with pale dingy reddish-brown.

The Common Pariah Kite : *Milvus migrans govinda* Sykes.

Hindūstāni name : *Cheel* : Mahrātti : *Ghār*.

Field identification : A large brown bird of prey, smaller than the Vulture, familiar to all. On the wing the forked tail distinguishes it from all similar birds. Singly or gregariously in the City and suburbs, especially about meat and fish markets and refuse dumps.

Specimen: *St. X. C.*: ♂—1932 Bombay (H.A.).

Resident. Common. EHA (*J.B.N.H.S.*, vi, 269) believed that the majority of Bombay kites retired to some drier region during the monsoon. This may be true of a few, but the greater number are certainly with us throughout the year. Living in the City is far too easy and plentiful for the birds to forsake it. The Pariah Kite is one of our most useful scavengers. Large numbers may always be seen about the fish and meat section of Crawford, and our other Municipal markets. Refuse dumps, where low lying areas are being reclaimed—such as at Mahāluxmi—never fail to attract them. The ease and grace with which a kite will swoop down on and carry off a dead rat or some similar tit-bit from a narrow, thickly congested lane with all its din and traffic, twisting and turning masterfully to avoid the overhead telephone and electric wires is entertaining to watch. Some of their favourite perches in the City are the ridges of roofs, flag-staffs or radio aerial poles, and above all the round wire cages surmounting the sewage-gas pipes which are such an eyesore on most Bombay buildings. Numbers may often be seen waddling about on our maidans and playgrounds, especially after the turf has been watered, picking out earthworms. On monsoon evenings when winged termites emerge from the ground, kites foregather in large numbers to feast on them in company with crows and other birds and the chase often continues well into the dusk. Whereas the crows snap up the insects in mid-air in their bills, the kites scoop them up in their claws. The victims are subsequently transferred to the bill in mid-air. Some of the birds post themselves on the ground near the ant-hole and 'tick off' the insects as they emerge. The Pariah Kite is an inveterate chicken thief and becomes a serious nuisance to poultry-keeping especially when it has nest-young to feed.

Breeding: We have observed a pair building as early as 22 September. The usual time for eggs is from late October to about February, but some may be found till the end of March. The nest is a large untidy platform of sticks with filthy rags, grass, bits of hairy goat-skin and other rubbish thrown in. It is placed in the fork of some large tree or cocoanut-palm in Bombay City and the suburbs, or in the vicinity of villages in Salsette. A favourite site in the City likewise is the metal 'basket' under the vane of many buildings such as the Secretariat and the High Court. The normal clutch consists of 2 or 3 eggs. These are greyish-white in colour, streaked, speckled and blotched in varying degree with reddish-brown.

[**The Black-eared** or **Large Indian Kite**: *Milvus migrans lineatus* (Gray).

According to H. E. Barnes (*Birds of the Bombay Presidency*, p. 57) Hume obtained a specimen of this kite in Bombay Harbour. On 12-3-30 S.A. observed a kite at Dharamtar (Kolāba Dist.) which was probably this species. The white in the lower wing coverts which distinguishes it from the Pariah Kite was conspicuous as patches in overhead flight. This would be a winter visitor to our area.]

The Black-winged Kite: *Elanus cœruleus vociferus* (Lath.).

Field identification: Size about that of the Jungle Crow, but somewhat lighter in build. Ashy-grey above, white below with black line over eye and black patch on closed wings—at shoulder. Singly, perched on poles, dead trees etc. in open scrub country and grassland. Flies with slow deliberate wing-beats like the Roller, and often hovers in ungainly fashion.

Specimens: *B.N.H.S.*: ♀ 9-2-24 Andhēri (S. H. Prater); ♂ 28-11-99 Hog Island, Bombay Harbour (E. Comber); ♂ 26-3-99 Trombay Island (Major H. J. Walton).

Status? Rare. It feeds principally upon lizards, grasshoppers and other insects, and mice. It hovers rather cumbrously—as compared with the Kestrel—to spy out the ground below, parachutes down with open wings—only the tips quivering—resumes hovering, then parachutes still lower to get a better view of the suspect and finally pounces upon its prey. When perched, it has a habit of cocking its tail from time to time and jerking it up and down between drooping wings. It will keep to the same locality for days together and may be seen perched on the same pole or tree day after day.

We have no record of its breeding in our area or the immediate neighbourhood.

The Pale Harrier : *Circus macrourus* (S. G. Gmelin).

Field identification : Size somewhat smaller than the Pariah Kite and much more slender-bodied. A lightly built ashy-grey hawk usually seen skimming gracefully over standing crops and grassland on long motionless black-tipped wings. The female is umber-brown with reddish markings above, paler below.

Specimens : *B.N.H.S.* : ♂ 29-2-08 Andhēri (N. B. Kinnear?) ; *St. X. C.* : 229 o? 12-3-35 Andhēri (H.A.).

Noted : Gōdhbunder, Thāna, Chembūr, Khār, Borivli etc.

Winter visitor. Not common, but frequent. Easily confused with the next species—Montagu's Harrier. Every now and again as the bird 'skims along the grass and skirts the bush, dips to the hollow and rises to the mound' as EHA so aptly describes its progress, it pounces upon some unwary lizard, mouse, grasshopper, or young lark and settles down to dispose of it before resuming its beat. It perches on the bare ground or on clods of earth in preference to a bush or tree.

Montagu's Harrier : *Circus pygargus* (Linn.).

Field identification : Differs in detail from the foregoing and difficult to tell from it with certainty except with practice. On the whole it is a somewhat darker grey with the black in the wing-tips more extensive. The female is also similar to but somewhat darker than that of the Pale Harrier. Habits etc. similar to the above.

Specimen : *B.N.H.S.* : ♂ Feb. 1913 Andhēri (N. B. Kinnear).

Winter visitor.

The Pied Harrier : *Circus melanoleucus* (Forst.).

Field identification : A typical harrier in build and habits, of conspicuous black and white plumage. The female is brown as in the two foregoing species, some white and greyish in the wings. Singly, in open grass country.

Winter visitor. Rare. We have only observed a solitary example about the mud-flats at Sion Causeway on 8 April (1924) presumably on passage. It was excessively shy.

The Marsh Harrier : *Circus aeruginosus aeruginosus* (Linn.).

Field identification : A dark umber brown hawk rather like the Pariah Kite but slimmer, with rounded tail, and usually with a creamy-buff cap. Adult males have silvery grey wings and tail. Usually seen singly about marshes and jheels beating back and forth above the reed beds etc. and pouncing on frogs, disabled birds and the like.

[Specimen : *St. X. C.* : 119 ♂ 13-10-33 Bassein, Thāna Dist. (H.A.).]

Noted at snipe marsh near Gōdhbunder Creek, Māhim, Bandra.

Winter visitor. Rare. EHA says '. . . in times now almost ancient when the Flats were inundated every monsoon and did not dry for months after, it was very fond of Bombay'.

The Indian Shikra : *Astur badius dussumieri* (Temm.).

Mahrātti name : *Cheepak.*

Field identification : Size about that of the Pigeon. Ashy-grey above white below cross-barred with rusty-brown. Young birds brown and rufous above with broad brown streaks on the lower plumage. Tail in adults as well as young with broad blackish bands. Singly or pairs, in wooded country around villages and about mango topes etc.

Specimens : *B.N.H.S.* : ♀ 1-2-24, ♂ 19-1-24, o? -2-25 Andhēri (S. H. Prater) ; ♂ 12-1-13 Santa Cruz ; ♀ 9-10-06 Bombay City (Mr. Keyes) ; ♀ 9-1-19 Malabār Hill, Bombay (W. S. Millard) ; *St. X. C.* : [147 o? 25-10-33 Kihim], 175 ♀ 20-2-34 Andhēri (H.A.).

Resident. Fairly common. Its food consists of small birds, rats, squirrels, lizards, and also locusts and large grasshoppers. It is very destructive to young chickens and on this score is a nuisance about villages, particularly when it has nest-young to feed. The tactics usually employed by the Shikra in capturing its prey is surprise. From its perch in the concealment of some leafy tree, whence it keeps a sharp lookout, it swoops upon and bears away its victim before the latter has time to scent danger.

Breeding : We have not actually taken any nests in our area, but the Shikra must undoubtedly breed here. From the excitement of a pair noted near Mulund at the end of March, it was obvious that they had a nest nearby.

The Southern Besra Sparrow-Hawk : *Accipiter virgatus* (*besra* Jerdon?).

Field identification : Difficult. Size about that of the Shikra and rather similar to it in colour and markings. In the hand the conspicuously greater length of the middle toe most readily serves to differentiate the two.

Status? Rare. We have not come across the Sparrow-Hawk in Salsette, but in the B.N.H.S. Collection there is a specimen (♂ imm.) obtained by Mr. N. B. Kinnear at Tūlsi Lake, 16-12-12.

The Indian Crested Honey-Buzzard: *Pernis ptilorhynchus ruficollis* Lesson.

Field identification : Somewhat larger than the Pariah Kite. Usually greyish-brown above, pale brown below narrowly cross-barred with white. A blackish crest at back of head. In overhead flight the rounded tail—cross-barred black and white—and the more finely barred undersurface of wings conspicuous. Singly, in wooded country, often soaring in circles above the forest. The forehead, sides of head and chin covered with small scale-like feathers is a diagnostic feature of the bird in the hand.

Specimen : *B.N.H.S.* : ♀ 29-1-25 Andhēri (R. Hearn).

Resident. Not uncommon in the hilly and forested parts of Salsette. It derives its name from its habit of feeding on the honey and larvae of wild bees. The call is a high-pitched screaming whistle *whee-ee-ew*.

Breeding : Barnes (*J.B.N.H.S.*, iii, 219) writes that Davidson had eggs of the Honey-Buzzard sent to him from Thāna, taken about March. On 24 April (1935) H.A. found a stick nest about 60 feet up in a Casuarina tree 50 yards from the sea-shore at Kihim (Kolāba Dist.). On 6 May it contained two downy chicks one of which was considerably larger than the other. This suggests that the interval between the laying of the first and second egg—for normally only 2 are laid—is a long one, and that incubation commences immediately the first egg is laid. He took the larger chick (♂) and found its stomach to contain the remains of a Green Whip Snake (*Dryophis mycterizans*) and numerous larvae of hymenopterous insects. There was a large colony of several bee-hives within half a mile of the nest whence the latter presumably came. The owners made no attempt to defend the nest when climbed up to.

On 25 May of the following year H.A. found the same nest again occupied, with young in it.

The Southern Green Pigeon : *Crocopus phoenicopterus chlorogaster* (Blyth).

Field identification : Size that of the Pigeon. General colour greyish and yellowish olive-green. Head and neck ashy-grey, breast and abdomen yellow. Flocks in wooded country feeding on ripe fruits of Banyan and Peepal.

Specimen : *St. X. C.* : 251 o?—Gōdhbunder (H.A.).

Status? Not common. We have only come across occasional small parties of 3 or 4 birds about Gōdhbunder and Shendūr in north Salsette. The call is a pleasing mellow whistle of several notes.

We know of no breeding records in our area or the immediate neighbourhood.

[**The Grey-fronted Green Pigeon :** *Dendrophasa pompadora affinis* (Jerdon).

Field identification : Smaller than the foregoing; about the size of the Ring-Dove. General colouration as above, but with the back and wing-shoulders maroon-chestnut, and breast pinkish-orange.

H.A. obtained a specimen of this Green Pigeon at Karnāla Fort (Funnel Hill) in the Panvēl Taluka of Kolāba Dist. on 25 February (1934) and observed several birds in heavy forest at about 1,000 ft. elevation there. He also came across it at Tūngār, Bassein, *ca.* 1,300 ft. on 20 April (1934).

W. F. Sinclair (*J.B.N.H.S.*, xii, 185) records a specimen shot in the Police Lines at Alibāg out of a flock on 20 July (1890).

We have not come across it in Salsette, but it no doubt occurs here from time to time in small numbers.]

[**The Imperial Green Pigeon :** *Muscadivora aenea pusilla* Blyth.

Field identification : Size between the Blue Rock Pigeon and the Jungle Crow. Head, neck and lower plumage pinkish-grey, upper plumage metallic bronze green.

Not observed in Salsette, but there is a specimen in the Society's Collection shot on Tūngār Hill near Bassein Rd. Station (B.B. & C.I. Railway) 34 miles north of Bombay, on 19-1-19 by a Mr. Frei. This specimen has been recorded as *C. ae. aenea* by Mr. Kinnear (*J.B.N.H.S.*, xxvi, 846) but according to the boundary between the races recently fixed by Whistler (*J.B.N.H.S.*, xxxviii, 675) it should be *pusilla*.

H.A. has verified another example shot in the same locality on 26-5-1935.]

The Indian Emerald Dove : *Chalcophaps indica indica* (Linn.).

Field identification : Size that of the Myna or of the Little Brown Dove. Colour scheme resembling that of the Imperial Green Pigeon. Metallic bronze-green above; head, neck and underparts vinous red and pinkish-grey. Usually singly or pairs, feeding on roadsides in the wooded parts of north Salsette such as along the Gōdhbunder-Thāna road or flying across them at great speed, the metallic bronze flashing in the sun.

Specimen : *B.N.H.S.* : ♂ 25-3-29 Tūlsi Lake environs (S.A.).

Noted : Powāi and Vihār Lakes, Gōdhbunder, Borivli, Trombay, Chembūr.

Resident (presumably). Not abundant but frequent in suitable country. Feeds on the ground on seeds and vegetable matter and there is usually a quantity of grit in the stomach.

Breeding : We have not come across any nests of the Bronze-winged Dove in Salsette but from the enlarged condition of the gonads of the specimen (measuring 14×7 mm.) it was evidently preparing to breed.

The Indian Blue Rock Pigeon : *Columba livia intermedia* Strickl.

Hindūstāni name : *Kabūtar,* Mahrātti : *Pārwa.*

Too well-known to need description.

One of the commonest birds in the City where large gatherings are fed regularly at recognised places by benevolent Hindu gentlemen. There is much admixture of domestic strains in the pigeons inhabiting our area and the race is perhaps about as pure as the Aryan of Nazidom!

Breeding : Pigeons breed freely throughout the year everywhere in buildings in the noisiest and most congested parts of the town, making flimsy twig nests on rafters and cornices, under eaves, in ceilings, under the iron water reservoirs on buildings and in holes in masonary wells. The usual 2 white eggs are laid. In a small disused loft, between ceiling and roof, in St. Xavier's High School at Dhobi Talao, H.A. counted 35 nests all containing either eggs or downy chicks on 8 February (1936).

The Indian Rufous Turtle-Dove : *Streptopelia orientalis meena* (Sykes).

Field identification : Slightly smaller than the Pigeon. Head greyish-brown. Upper plumage with scale-like rufous markings; lower plumage pale pinkish-rufous. A black patch on either side of hindneck, speckled silver-grey. White tips of tail feathers conspicuous as a band when the bird is alighting. Usually singly, in wooded country about cultivation.

Specimen : *B.N.H.S.* : ♀ 26-1-24 Andhēri (S. H. Prater).

Winter visitor. Rare. H.A. has seen two specimens shot near Powāi Lake in March. We have no other records.

The Indian Spotted Dove : *Streptopelia chinensis suratensis* (Gmel.).

Mahrātti name : *Kaura.*

Field identification : Size between the Myna and the Pigeon. Similar in colour to the foregoing species, but spotted with white on upper parts. A distinctive black patch with white spots on hindneck—'chessboard'. Singly, in pairs or parties, in lightly wooded country gleaning in stubble-fields, on cross-country cart tracks, etc.

Specimen : *B.N.H.S.* : ♀ 6-4-13 Santa Cruz (N. B. Kinnear).

Resident. Fairly common. We have not observed it in City limits, but it is the commonest dove in Salsette. Its call is a pleasant though rather mournful *Kroo-kruk-kruk-kroo—kroo-kroo-kroo.* The number of *kroos* varies, but is never more than 6 times.

Breeding : We have records of nests in Salsette, in course of building or with eggs and young, in March, August, October and November and they probably breed more or less throughout the year. A flimsy twig nest is built in a bush or tree usually low down or at moderate heights from the ground. 2 white eggs invariably comprise the full clutch.

The Little Brown Dove : *Streptopelia senegalensis cambayensis* (Gmelin).

Field identification : Size about that of the Myna. Earthy brown above with greyish on wings. Head, neck and breast pinkish-brown paling to whitish on abdomen. On each side of neck there is what EHA calls 'a miniature chess-board in red and black'.

Specimen : *B.N.H.S.* : ♂ 12-9-12 Cumballa Hill, Bombay (N. B. Kinnear).

Straggler? Rare. We have never come across this dove in Bombay and curiously enough even in Salsette have noted it only once at Gōdhbunder (1924), once near Ghātkōpār (1926), and a solitary example at Andhēri (1934). EHA (*C.B.B.*, p. 152) wrote in the eighties that all the doves he had seen about Cumballa and Malabār Hills belonged to this species. If this is true then their absence now must certainly be attributed to the transformation these localities have undergone since EHA's day, and is a good example of the effect of changing environment upon bird distribution. The Little Brown Dove loves dry stony country with prickly pear and other cactus thickets which have long since disappeared from Bombay, Cumballa and Malabār Hills, before they were built up and out of all recognition, doubtless fulfilled its ecological requirements.

In *J.B.N.H.S.*, xxiii, p. 158 (April 1914) Mr. Kinnear wrote that this species, along with the Spotted and the Ring-Doves, was 'very common' on the southern end of Salsette. This is definitely not the case at present as our meagre records will show. Across the Harbour—Kolāba Dist.—however, it is fairly common. A nest with 2 chicks—about 2 days old, in clotted yellowish down—was seen near Kihim on 19-2-31. It was the typical flimsy pad of small twigs 3 ft. up in an Euphorbia bush close to the village.

The Indian Ring-Dove : *Streptopelia decaocto decaocto* (Frivalszky).

Field identification : Somewhat smaller than the Pigeon. More or less uniform pale brownish lilac-grey with a black collar on hindneck. In Babul jungle and about cultivation.

Specimen : *B.N.H.S.* : (destroyed) ♀ 30-1-21 Santa Cruz (B. C. Ellison); o? 1-12-25 Kūrla, Bombay Suburban Dist. (D. A. Baretto).

Noted : Gōdhbunder (December 1925).

Mainly a local winter visitor. In December we have observed flocks flying high up in the air, once near Kūrla and on another occasion at Gōdhbunder (several successive flocks), distinctly suggestive of migratory movement. Kinnear (*J.B.N.H.S.*, xxiii, 158) appears to have found it common on the southern end of Salsette. No season is specified. Its call is a pleasant deep *Kuk-koo-kook, kuk-koo-kook* etc.

The Indian Red Turtle-Dove : *Œnopopelia tranquebarica tranquebarica* (Herm.).

Field identification : Size about that of the Myna. A pinkish brick-red dove with ashy-grey head and black collar on hindneck. The female is pale brownish-grey, rather like a small replica of the Ring-Dove. Singly or pairs, gleaning in stubble-fields often in company with other doves.

Specimens : *B.N.H.S.* : o? 10-2-24 Pāli Hill (S.A.); ♂ 27-12-23 Andhēri (S. H. Prater); ♂ 5-12-25 Kūrla (D. A. Baretto).

Local winter visitor. Uncommon. The call is a somewhat harsh rolling *Groo-gurr-goo, groo-gurr-goo* etc.

[**The Common Indian Sand-Grouse :** *Pterocles exustus ellioti* Bogdanow.

There is a specimen of this sand-grouse in the B. N. H. S. Collection from Bassein, Thāna Dist. (without date) collected by P. Lyons. We have not come across it in Salsette.]

The Common Peafowl : *Pavo cristatus* Linn.

This gorgeous bird was evidently fairly plentiful in Salsette in olden days, but at the present time it has all but disappeared. John Fryer, in an account of his travels in India in the year 1673, writes that outside 'Bandora' he used his fowling-piece 'being presented with rich game as peacocks, doves and pigeons.'

Up till about the year 1910 or thereabouts S. A. remembers that small parties of peafowl were occasionally to be met with on the eastern wooded slopes of Trombay Hill, but we have not seen or heard of them there within recent years. A local shikari informed H. A. in 1936 that a few may still be occasionally driven out in beats in north Salsette. According to this informant it was met wih there oftener than the Junglefowl.

H. A. picked up a peacock feather on Karnāla Fort Hill (Panvēl, Kolāba Dist.) in February 1934.

The Grey Jungle-Fowl : *Gallus sonneratii* Temm.

Field identification : Very like the domestic fowl in appearance. General effect streaked grey with a black sickle-shaped tail. Hen brown above white below with black streaks. In hilly forest country with scrub undergrowth.

We have seen a specimen shot by a Mr. C. King in the hills round Powāi Lake in 1924. H. A. observed a single bird at Gōdhbunder in April 1934. The Grey Jungle Fowl is now rare in Salsette and becoming increasingly so under ceaseless persecution from bands of local shikaries. It is not uncommon in parts of Kolāba District. We have shot several at Parōl Pāra in Alibāg Taluka (1931). An adult cock in good condition and quite uninjured, when suddenly come upon by the beaters, was so terrified that he could not take to wing. He hopped and fluttered a few yards and began running through the bushes till overtaken by the men and done to death with sticks! The stomachs of specimens contained the green fruits and seeds of *Streblus asper* predominatingly. A bird shot in January was a cockerel about three months old indicating the breeding season to be somewhere about September-October.

The Common Red Jungle-Fowl : *Gallus gallus murghi* Robinson and Kloss.

Mr. C. McCann of the Bombay Natural History Society, a keen and reliable observer, informs us that on 24 February 1929 when accompanied by Rev. Fr. Palacios S. J., they saw a Red Jungle cock on the hills behind Kaneri Caves, Borivli, at about 1300 ft. elevation. It was within shooting distance and stood for a few seconds before scuttling away, giving them a perfect view. This record has not been confirmed by a specimen or another sight record since. Salsette and the neighbouring country is far out of the known range of the Red Jungle-Fowl.

The Red Spur-Fowl : *Galloperdix spadicea spadicea* (Gmelin).

Mahrātti name : *Chikōkri.*

Field identification : Size and general effect that of a three-quarter grown domestic hen, the cock mainly chestnut brown, the hen paler brown with black streaks and markings. Usually in pairs, but seasonally in family parties, in stony, broken country—nullahs, etc. overgrown with thickets and brushwood.

Specimens : *B.N.H.S.* : o? 16-3-24 Vihār Lake (S.A.) ; ♀ 8-12-18 Thāna (Major M. L. Ferrar) ; *St. X. C.* : 243 ♂ 24-11-35 Borivli (H.A.).

Noted : Kandivli, Gōdhbunder, Powāi and Tūlsi Lake environs. Also Karnāla and Parōl Pāra on the mainland.

Resident. Not uncommon in northern Salsette and on the adjoining mainland. The birds are usually shy and great skulkers, scuttling away through the undergrowth on the least suspicion and flying for short distances only when hard pressed, often seeking concealment in the branches of a tree. Their food consists of seeds and insects which are rummaged for among the fallen leaves. They have a habit of running uphill when alarmed.

Breeding : H.A. has seen a clutch of 3 eggs taken from a scrape in the ground near Tūlsi Lake on 15-4-36. He was informed that young had been captured in this locality at the same time. On 31-5-36 (Vihār) he observed 4 newly hatched chicks. The Red Spur-Fowl is said (*Fauna*, v, 360) to breed throughout the year except perhaps in the three months October to December.

The Common or Grey Quail : *Coturnix coturnix coturnix* (Linn.).

Field identification : Size about that of a ten-day old domestic chicken. Squat, plump appearance. A seemingly tailless, buff-coloured game bird with black streaks and markings. Usually singly or pairs, flushed in cultivation and grassland with a whirr of wings.

Specimens : *B.N.H.S.* : o -1-96 'Bombay' (J. M. Mason) ; ♀ 18-1-07, ♂ 19-1-07, ♂♂♀ 7-12-07, ♀18-1-08 Thāna (W S. Millard and N. B. Kinnear) ; *St. X. C.* : 240 o?, 241 o? (Salsette) November-December 1935 (Nunes).

Winter visitor. Found in small numbers in grassland and about harvested paddy fields. By December or January they are well in; by about the beginning or middle of March most birds have departed.

The Black-breasted or **Rain Quail:** *Coturnix coromandelica* (Gmelin).

Field identification: Somewhat smaller than the Grey Quail. Like it in general effect and habits, except that in this the male has a jet black breast. Singly or pairs in grassland.

Specimens: *B.N.H.S.*: ♀ 18-1-07, ♂ 8-1-10 Thāna (N. B. Kinnear); ♂ 2-12-08 Thāna (W. S. Millard).

Not common. We are not aware if the Black-breasted Quail is at all resident in our area or moves in locally during the cold weather only, as the majority certainly appear to do. We have no record for Salsette at any other season of the year.

The Jungle Bush Quail: *Perdicula asiatica asiatica* (Lath.).

Field identification: Size about that of the Common Quail. Male above fulvous-brown with blackish and buff streaks, below white cross-barred with black. The female has the lower parts pinkish-rufous. In coveys of 5 to 15 birds, in scrub jungle.

Specimens: *B.N.H.S.*: ♂ ♀ 24-11-12 Borivli (N. B. Kinnear); ♂ juv. 7-2-08, o? juv. 24-2-08 Andhēri (N. B. Kinnear); o? downy chick -12-23 Andhēri (S. H. Prater).

Resident. Common in scrub jungle in Salsette. Bush Quails have a habit of forming themselves into 'squares'—crouching huddled together under a bush, or even in the open, all facing outwards—and of suddenly 'exploding' or rising with a whirr and dispersing in all directions often when almost trod upon. The covey soon reunites by means of soft whistling calls uttered by the members. They roost at night in the same manner and are easily captured by throwing a net over the bush into which a covey has been observed to retire. Rival males occasionally challenge rivals by harsh grating calls as of the Black Drongos 'arguing' at the onset of their breeding season. What emotion these calls really signify is not certain, but they are clearly associated with breeding.

Breeding: There seems to be no well-defined nesting season, but in our area the majority seem to lay from about October to March or April. We have seen a c/4 (hard-set) taken at Jogēshwari on 30 January, and chicks in down in December, February and April. EHA (*C.B.B.*, p. 159) says it lays about the end of the rains. The nest is a slight depression in the ground lined with grass, under shelter of a bush or grass-tussock in scrub country. 4 to 8 eggs of a creamy-white colour are laid. The chicks, as with all game birds, are able to run about as soon as hatched, and to fly when incredibly tiny. Their colour and pattern render them completely invisible in their surroundings of dry grass and leaves.

The Rock Bush-Quail: *Perdicula argoondah* ssp.

Specimen: *B.N.H.S.*: ♂ juv. 24-2-08 Andhēri (N. B. Kinnear).

We have not knowledgably come across this species in Salsette. Its differentiation in the field from the Jungle Bush Quail is almost impossible.

The Southern Painted Partridge: *Francolinus pictus pictus* (Jard. and Selby).

Field identification: A plump, stub-tailed game bird, larger than the Quail, about the size of a half-grown pullet of the domestic fowl. Black, profusely spotted and barred with white and with some rufous-red in the wings. Singly, about cultivation and grassland, usually not far from water.

Specimen: *B.N.H.S.*: ♂ 24-2-08 Andhēri (N. B. Kinnear).

Noted: Kandivli, Mulund, Thāna. One shot at Chembūr (Trombay Hill) on 27 May 1914, but none met with there since.

Resident? Not common and becoming scarcer day by day. There is evidently an influx of local visitors during the rainy season and more birds may be heard calling from about August to October in Salsette (as well as across the Harbour e.g. in Alibāg Taluka) than at any other time of year. This may, however, be partly accountable by the fact that the birds are breeding then. In the rains they keep to the vicinity of paddy-fields and have a habit of mounting stones, etc. on grassy bunds separating the fields—or an isolated tree standing in the midst of cultivation whence a good view of the surrounding country can be obtained—and uttering their familiar call *Chik . . . cheek-cheek-keray*. They call mostly in the mornings upto about 11 o'clock and then from 3 p.m. onwards.

Mr. N. S. Symons addressing a meeting of our Society on 14 January 1891 on the subject of a proposal for the protection and introduction of game into the Bombay neighbourhood (*Jour.*, vi, 120) mentioned that he had heard of as many as ten brace of Painted Partridge having been killed by one gun within 18 miles of Bombay that season in a short day's sport. He complained that for want of protection the birds were already then dwindling considerably in numbers.

Breeding: The Painted Partridge undoubtedly breeds in parts of Salsette and on the adjoining mainland during the monsoon—July to September—but we have no specific records of eggs or young having been taken here. A favourite site for nests is on the grassy bunds that separate fields. The normal clutch comprises of 4 to 8 eggs, pale olive grey in colour.

The Common Bustard Quail: *Turnix suscitator taijoor* (Sykes).

Field identification: Size somewhat smaller than the Rain Quail. General effect reddish brown above with a greyish tinge, rusty-buff below with black cross-bars on breast. The female has the chin, throat and breast black. In flight the pale buff shoulder patches are conspicuous on upper surface of wings. Distinguished in the hand from true quails by absence of hind-toe. Pairs or small parties of 3 or 4 in scrub undergrowth about grassland and cultivation.

Specimens: *B.N.H.S.*: o? 9-2-07, o? 7-12-07 Thāna (W. S. Millard).

Noted: *Salsette*: Chembūr, Andhēri, Powāi Lake environs; *Mainland*: Kihim, Alibāg, Rōha.

Resident. Not uncommon, in small numbers. Contrary to the normal condition in birds, the female of the Bustard Quail is more brightly coloured than the male. This is because the usual role of the sexes is reversed in this species. The hen does all the courting and fighting with rival hens; the cock incubates the eggs and rears the young while she is busy making fresh conquests. The call uttered by the hen is a loud drumming *Drr-r-r-r-r-r* etc. often continued for 10 to 15 seconds at a stretch. We have also heard a more subdued *Hoon-hoon-hoon-hoon* for over 5 seconds at a time, probably uttered by the cock. They are birds of sedentary habits and a pair or party may be found frequenting the same spot day after day.

Breeding: We have found eggs and chicks from March to September. It lays on the ground in a grassy patch, bending over the grasses neatly into a sort of dome. The normal clutch is of 3 or 4 eggs, usually greyish-buff with reddish-brown spots and speckles.

The Little Button Quail: *Turnix sylvatica dussumieri* (Temm.).

Field identification: Considerably smaller than the Quail. In general appearance like the Bustard Quail but differentiated chiefly by not having the breast barred, by its white or greyish legs (as compared with leaden grey or slate in that bird) and by its stub-tail being pointed. Singly or pairs, in grassy country.

No specimens, but H.A. has observed the Button Quail at Borivli (Salsette) and across the Harbour at Kihim (Kolāba Dist.).

Resident, presumably, but uncommon.

(*To be continued*).

THE BIRDS OF THE LACCADIVE ISLANDS.

BY

F. N. Betts.

(*With a plate*).

Although the Laccadive Archipelago lies but 150 miles or so off the West coast of India, the islands are seldom visited by strangers except for the biennial Government inspection, and the only account of their avifauna in any way complete is that of Hume who made a fortnight's tour of the group in February 1875, in the survey ship *Clyde*, and published his results in *Stray Feathers*. In his *Short Account of the Laccadive Islands,* R. C. Ellis, I.C.S., who made four official inspection tours thither, gives a list of birds; but I am unable to say from what source this was obtained and several of the records seem open to doubt.

With the hope of being able to add to this scanty store of knowledge, I spent a fortnight among the Northern islands of the group in February of this year. The only means of getting there was to travel in one of the small island sailing craft which trade with Mangalore, and, as the various islands lie at distances of twenty to forty miles apart and communication is entirely dependent on favourable wind and weather, I was only able in the time at my disposal to explore four of the inhabited islands, and failed to reach the outlying reefs which would have yielded the most results ornithologically. My visit cannot be said to have been fruitful as I only encountered two hitherto unrecorded species both of which are regular winter migrants on the mainland.

Changes are few and slow in action in this out-of-the-way corner, and every word of Hume's interesting and entertaining account, although written over sixty years ago, applies today. As however *Stray Feathers* is long out of print and no longer accessible to everyone, it may not, I hope, be considered out of place to collate the available information on the scanty Avifauna of the Laccadives with such little original observations as I was able to make myself.

The Laccadives lie between the parallels of 14 and 10 North, and consist of a number of coral atolls and reefs, some submerged and others appearing as isolated islands or sandbanks. There are nine main inhabited islands and several small islets which, though covered with vegetation, are unoccupied owing to lack of fresh water. Most of the islands lie well out of sight of each other with the exception of Amini and Kadmat which are only six miles apart. They are all very similar, low and sandy, nowhere rising more than ten feet above sea level, lying on the Eastern edge of a circular coral reef exposed at low tide, whose Western portion encloses a shallow lagoon of varying size. They range in area from 10 acres to 1,000 and those that are inhabited are mostly thickly populated. These latter are densely planted from end to end with

BIRDS OF THE LACCADIVE ISLANDS.

Coral Reef at Kadmat.

Banyan grove at Kiltan.

coconuts, and there is very little other vegetation. A few breadfruit, drumstick trees and limes are grown, and on one or two of the islands one sees small patches of yams and other vegetables, while everywhere a sparse growth of grass springs up in the monsoon though there was little left, except on Kiltan, at the time of my visit.

Apart from this cultivated flora, a certain amount of scrub grows above the tide line and in the more infertile areas, chiefly a laurel-shrub (*Scaevola koenigii*), wild heliotrope (*Tournefolia argentea*), and a bushy shrub (*Pemphis acidula*), which is used for firewood. The uninhabited islands are covered with a dense jungle of screwpine (*Pandanus* sp.). One or two tamarinds and banyans occur, particularly on Kiltan where there is quite a grove at the Southern end of the island. The shores along the highwater mark carry a growth of Spinifex and creeping purple convolvulus (*Ipomoea biloba*).

Invertebrate life is very scarce, grasshoppers occur in small numbers, sandflies on one or two of the islands, and ants, mostly of house-haunting varieties, but there appear to be no spiders or termites, and the few butterflies one sees are doubtless windblown from the mainland. There is little therefore to support land birds, and there are only two resident species, the House Crow, no doubt introduced by human agency and almost entirely parasitic on mankind, and the White-Eye, which seems to live very largely on honey from the flowers of the coconut trees.

I noticed a remarkable absence of seafowl in the neighbourhood of the main islands. It was not until one got well off shore that one came on flocks of Terns pursuing the shoals of small fish which were chased to the surface by porpoises or sharks. This is the more remarkable as the sandbanks of Cherbaniani and Pitti are the breeding grounds of myriads of various pelagic Terns. I imagined this scarcity might be due to the fact that the birds were away at their nesting stations but was told that it was always the case.

Until about 1830 the seafowl used to breed in enormous numbers at Bitra, the most northerly of the islands on which vegetation grows, but for some reason this was suddenly deserted and they are now found only on the outlying sandbanks. Hume found *Anous stolidus* and *Sterna fuliginosa* breeding at Cherbaniani in February whilst *Sterna bergii* and *Sterna anœtheta* were still in winter plumage. These probably go to Pitti where I was informed there was an enormous colony of seafowl which lay in May, and the islanders make trips there regularly to collect eggs. Strange to say, Major Alcock in his *Naturalist in the Indian Seas* writes that when he went to Pitti at the end of November in the R.I.M.S. *Investigator* in 1891 he found the whole sandbank literally covered with the young of two species of Terns which he failed to identify, so that it looks as if there must be two breeding seasons.

If the avifauna of the islands is poor in numbers, the sea between them and the mainland is a desert. During the passage which took 30 hours outward bound and three days on the return journey the only birds we saw were two Tropic Birds, a few Shearwaters and one flock of Sooty Terns chasing a shoal of fish. Three or four miles off the South Canara coast we passed three Great Black-headed

Gulls, *Larus ichthyaëtus*, resting on the water. Approaching Mangalore at midday, soon after the daily sea breeze had settled down to blow, very large numbers of *Sterna bergii*, all in winter plumage, began to cross our bows in small flocks heading straight out to sea. The tide was just on the flood at the time, and presumably the fish were beginning to move and the birds which had been resting on the shore were going out to feed.

1. **The House Crow.** *Corvus splendens splendens* Vieill.

Only occurs on Androth, Kalpeni, and Amini. They were numerous on the latter island and fed chiefly on garbage. I saw one on February 22nd collecting dead twigs under a casuarina tree near the Kachcheri and carrying them to a nest in a neighbouring coconut palm. Strangely enough though Kadmat is only six miles away and plainly visible, they have not penetrated there. I was told that one was taken over on one occasion by an islander a few years ago and lived there for some time till it took to attacking the kids of the milch goats, after which the inhabitants persuaded the Monegar to shoot it.

2. **Brown Shrike.** *Lanius cristatus cristatus* Linn.

I saw a solitary specimen in the scrub at the uninhabited Southern end of Kiltan. This, I believe, is the first record from the group.

3. **House Martin.** *Delichon urbica urbica* Linn.

This species is recorded by Ellis, but I should think it is extremely doubtful whether it has occurred.

4. **Small Ceylon White-Eye.** *Zosterops palpebrosa egregia* Madarasz.

The *Fauna* records this subspecies as occurring in the Laccadives. I unfortunately did not obtain specimens in confirmation. Hume found them on all the islands visited. I found them numerous at Kadmat and Kiltan, rare on the barren Chetlat, and strangely enough did not see one at Amini. Perhaps the Crows have something to do with that. The birds seemed to be paired but I did not find any nest.

5. **The Koel.** *Eudynamis scolopaceus scolopaceus* Linn.

Obtained by Hume on all the islands he visited. Ellis says that it breeds on Kavarathi, but since there are no crows there this seems on the face of it impossible. I saw none though I was told that cuckoos of sorts were common at times, particularly among the banyans and scrub at the southern end of Kiltan. I searched this area and failed to find any but thought I heard one.

6. **The Brown Wood Owl.** *Strix indranee indranee* Sykes.

In Hume's day a pair of these existed on Bitra, the survivors of several which the Government had sent over to control the rat plague. They were not popular with the Islanders, and none remain as far as I know.

7. **The Osprey.** *Pandion haliaëtus haliaëtus* Linn.

I saw one at Kadmat sitting on a rock on the reef, and another at Kiltan eating a fish on top of a post on the shore which used at one time to carry a light. Hume and Ellis do not record it. It is no doubt a casual migrant.

8. **The Peregrine.** *Falco peregrinus* subsp.

Hume records this bird as a fairly regular migrant appearing at all times of the year but not breeding. He saw it at Amini, Bangaram and Kavarathi and heard of it at Kiltan. I did not see it.

9. **The Kestrel.** *Cerchneis tinnunculus tinnunculus.*

Hume found it on all the islands visited. I saw a party of three at Amini and a solitary bird on Kadmat but did not shoot any. Those Hume obtained he assigned to this subspecies.

10. **White-headed Sea-Eagle.** *Haliaëtus leucogaster* Gmelin.

Hume saw one soaring over Amini. I did not come across it.

11. **Pariah Kite.** *Milvus migrans govinda* Sykes.

Hume did not actually see this bird but reports it on hearsay. I also did not meet any but was told that Kites turn up no infrequently and steal chickens.

12. **Black-winged Kite.** *Elanus caeruleus vociferus* Lath.

Hume obtained this species at Amini and Kadmat. I did not see it, nor does Ellis record it.

13. **Pale Harrier.** *Circus macrourus* Gmel.

Recorded by Ellis. I saw two at Kiltan myself. Presumably these and the other birds of prey must subsist largely on rats and domestic chickens when they can be got as there is very little else for them to prey on.

14. **Montague's Harrier.** *Circus pygargus* Linn.

Reported by Ellis.

15. **White-breasted Waterhen.** *Amaurornis phoenicurus phoenicurus* Penn.

Ellis recorded this bird as a resident. I did not see it nor does Hume record it, and it seems unlikely that a bird of such weak wing-power should have wandered so far unless assisted.

16. **Crab Plover.** *Dromas ardeola* Payk.

Hume saw a flock on Peremal Par. Ellis records it as resident. I did not see it.

17. **White-cheeked Tern.** *Sterna repressa* Hartert.

Hume obtained two immature specimens at Cherbaniani.

18. **Little Tern.** *Sterna albifrons* subsp.

Hume obtained several at Cherbaniani.

19. **Large Crested Tern.** *Thalasseus bergii edwardsi* Mathews.

Hume saw a large flock at Peremal Par and a few at Cherbaniani and one at Bangaram. I saw none among the islands though they were numerous on the mainland coast.

20. **Lesser Crested Tern.** *Thalasseus bengalensis bengalensis* Lesson.

Hume saw a large flock at Peremal Par, as well as some at Cherbaniani and thinks they breed there.

21. **Panayan Tern.** *Sterna anaetheta antarctica* Lesson.

Hume found them in enormous numbers at Cherbaniani in February in winter plumage.

22. **Sooty Tern.** *Sterna fuscata infuscata* Licht.

Hume found it breeding in vast numbers at Cherbaniani in February. I saw flocks well out to sea between the islands feeding on shoals of fish driven to the surface by sharks and porpoises but never within seven or eight miles of land. We passed quite close to one resting on the back of a sleeping turtle.

23. **Philippine Noddy.** *Anous stolidus pileatus* Scopoli.

Hume found this species beginning to breed at Cherbaniani in the second week of February.

24. **Turnstone.** *Arenaria interpres interpres* Linn.

Hume calls this the commonest bird on the Laccadives. This is strange as Ellis does not mention it, and I failed to come across a single one on any of the islands I visited.

25. **Kentish Plover.** *Leucopolius alexandrinus* subsp.

Hume saw one at Kadmat and one at Bangaram. I did not encounter any and Ellis does not record it.

26. **Central Asian Small Sandplover.** *Cirrepidesmus mongolus artifrons.*

Hume obtained three at Kadmat. I shot one out of a flock of half a dozen at Kiltan, the only ones I saw.

27. **Large Sandplover.** *Cirrepidesmus leschenaultii* Lesson.

Hume obtained specimens at Kadmat and Kiltan. I did not see any.

28. **Eastern Golden Plover.** *Pluvialis dominicus fulvus* Gmelin.

Recorded by Hume and Ellis though I did not find it. Hume saw it on all the islands and says it was particularly numerous at Amini where there were at least fifty feeding on the shore or resting among the Spinifex above the beach.

29. **Curlew.** *Numenius arquata orientalis* Brehm.

Hume obtained two, one at Kadmat and one at Agathi, the only records.

30. **Whimbrel.** *Numenius phaeopus* Linn.

Hume found it at Amini, Kiltan and Bitra and it is recorded by Ellis. I met it on each island visited singly or in small flocks of three or four. They were very shy and would not allow approach within shot.

31. **Common Sandpiper.** *Tringa hypoleucos* Linn.

Hume records it as fairly common and Ellis includes it in his list. I found it the most numerous of any shore bird on all islands, particularly on Kiltan where they found the piled rocks of the storm beach on the Eastern shore particularly to their liking.

32. **Greenshank.** *Glottis nebularia* Gunnerus.

Hume shot one at Kadmat, the only record.

33. **Sanderling.** *Crocethia alba* Vroeg.

Hume shot a pair at Bitra. Ellis does not record it nor did I see one.

34. **Knot.** *Calidris tenuirostris.*

Hume saw a pair at Bitra, the only record.

35. **Australian Red-legged Gannet.** *Sula sula rubripes* Gould.

Hume identified a flock of Gannets seen near Peremal Par as this species. I saw none.

36. **Booby.** *Sula fiber.*

Hume saw single specimen of this Booby at Cherbaniani and Peremal Par. I am unable to trace the current correct name for this bird as it does not appear in the Synonymy of the *Fauna.* From the descriptions of the Islanders it seems highly likely that Boobies of some kind breed at Pitti in May.

37. **Short-tailed Tropic Bird.** *Phaethon indicus* Hume.

Hume obtained one not far from the Cherbaniani Reef. I saw two solitary specimens during the passage from the mainland both at least 50 miles from the nearest shore.

38. **Persian Shearwater.** *Puffinus persicus* Hume.

Ellis records this as resident, but neither Hume nor I ever noticed any Shearwaters anywhere near the Islands.

39. **Wedge-tailed Shearwater.** *Puffinus pacificus hamiltoni* Mathews?

During the passage from the Malabar coast I encountered several Shearwaters, all solitary and a great distance from land. All these had dark underparts and so could not have been *P. persicus.*

40. **Common Heron.** *Ardea cinerea rectirostris* Gould.

Hume saw several at Bangaram and says he saw stick nests in the trees which probably belonged to them though they were not breeding at the time of his visit. Ellis says there is a breeding colony on Viringilli, a small islet in the Minicoy lagoon. I saw two on the reef at Kadmat and one at Kiltan.

41. **Indian Reef Heron.** *Demiegretta asha* Sykes.

Hume saw one at Bitra, the only record.

42. **Little Greem Heron.** *Butorides striatus javanicus.*

Hume shot one at Kadmat. I saw one on the reef at Amini.

43. **Common Teal.** *Nettion crecca crecca* Linn.

Hume does not mention this but it is recorded by Ellis. I picked up a dried head on the beach at Amini and was told that they were regular winter visitors though in varying numbers, coming in very tired and tame and resting in the Mosque tanks and on the lagoons.

44. **Indian Pond Heron.** *Ardeola grayii.*

Hume saw one or two on Amini and Kadmat. The only one I saw I flushed out of the Mosque tank at Amini.

THE TAXONOMIC DESCRIPTION OF *RHINOPHIS TRAVANCORICUS* BOUL.

BY

BENI CHARAN MAHENDRA, F.Z.S.,

St. John's College, Agra.

(*With* 1 *plate*).

A recent examination of four specimens of the rare Uropeltid snake *Rhinophis travancoricus* Boul. makes it necessary to institute certain changes in its taxonomic description. Two of these specimens, which constitute the entire collection of this species in the Indian Museum, were borrowed by me from Dr. Baini Prashad; one came as a present from Prof. Padmanabha Aiyar, Maharajah's College of Science, Trivandrum; and the fourth from Prof. C. John, St. Berchmann's College, Chenganacherry.

The species *Rhinophis travancoricus* was instituted by Boulenger[1] in 1892 on the basis of a single specimen obtained by Mr. H. S. Ferguson[2] 'near Trivandrum, at the 6th mile-stone towards Vambayam, in June, 1892', and its first description, published in the *Journal of the Bombay Natural History Society* (January 1893),[3] was almost at the same time adopted, with slight modifications, in the *Catalogue of the Snakes in the British Museum.*[4] Sarasin[5] (1910) listed this species as endemic to South India, and Wall (1923),[6,7] made observations on its lepidosis. Quite recently, Smith[8] has revised Boulenger's description for his forthcoming volume on Indian *Serpentes*, and I am grateful to him for the following copy of his manuscript:

Rhinophis travancoricus Boul.

'Rostral not ridged above, separating the prefrontals for half their length, or a little more or less, the portion visible as long as

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[1] Boulenger, G. A., 'Description of a new earth-snake from Travancore.' *Jour. Bomb. Nat. Hist. Soc.*, 1892-93, vol. vii, p. 318.

[2] Ferguson, H. S., 'List of Snakes taken in Travancore from 1888 to 1895.' *Jour. Bomb. Nat. Hist. Soc.*, 1895, vol. x, p. 70.

[3] Vide footnote 1 above.

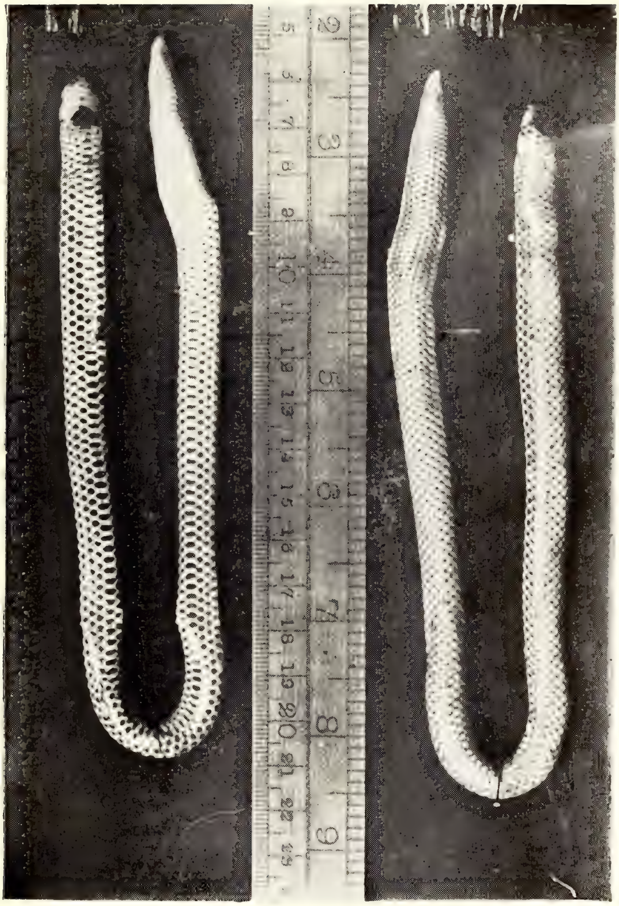
[4] Boulenger, G. A., *Cat. Sn. Brit. Mus.*, London, vol. i, 1893, p. 143.

[5] Sarasin, Fritz, 'Über die Geschichte der Tierwelt von Ceylon', *Zool. Jahrb.*, 1910, Suppl. 12, p. 137.

[6] Wall, F., 'A Hand-list of the Snakes of the Indian Empire,' *Jour. Bomb. Nat. Hist. Soc.*, 1923, vol. xxix, no. 2, p. 355.

[7] Wall, F., 'How to Identify the Snakes of India (including Burma and Ceylon', 1923, p. 17.

[8] Smith, Malcolm A., 'The Fauna of British India, including Ceylon and Burma. Reptilia and Amphibia, vol. iii, Serpentes.' (*In course of preparation.*)



Rhinophis travancoricus Boul.

Photograph of a record example presented to the author by Prof. C. John.

the distance between it and the hinder part of the frontal; frontal as long as the parietals; eye one-third the length of the ocular shield; scales in 17 rows; V. 132-146, one and a half times as broad as the adjacent scales; C. 5-7; caudal disc as long as the shielded part of the head; almost flat, covered with spicules.

'Dark purplish brown, the scales on the sides and belly edged with whitish; on the throat and fore part of the belly almost completely whitish; anal region black; lower surface of tail yellow.

'Total length 180, diameter 7 mms.

'*Range*. Travancore (Trivandrum, Pirmed, Ernakulum). Found at sea-level and in the hills to about 4,000 ft.'

With regard to the *rostral*, Smith (unpublished MS.) says, 'the portion visible as long as the distance between it and the hinder part of the frontal.' In all the four specimens examined by me, the portion visible is distinctly less than this distance, being nearly two-thirds of the latter. The diameter of the *eye* varies from one-third to two-fifths the length of the ocular shield. The number of *ventrals* in one specimen (viz., Prof. John's) is 151, and that exceeds the limit mentioned by previous authors by 5. *Scale rows* behind the head are 17, not 19 as recorded by Boulenger (1893).

The type specimen described by Boulenger measured 170 mm. Smith (unpubl. MS.) gives 180 mm. as the total length, and 7 mm. as the diameter of the body. Of the specimens examined by me, two, viz., no. 16482 of Ind. Mus., and Prof. Aiyar's specimen, measure 220 mm. in length, and that considerably exceeds the previous record. However, Prof. John's specimen is a veritable giant in this respect, being 320 mm. long. That beats the old records by 140 mm. !

Boulenger (1893), in the synopsis of the genus *Rhinophis* given by him, lays stress on the ratio between the diameter of the body and the total length, and says in connection with *R. travancoricus*, 'the diameter of body 34 times in the total length.' The present examination does not bear him out in this respect, as the following measurements show:

Specimen	*Total Length*	*Diameter*	*Ratio*
16481 (Ind. Mus.) ...	160 mm.	$6\frac{1}{2}$ mm.	$24\frac{8}{13}$
Aiyar's	220 ,,	$7\frac{1}{2}$,,	$29\frac{1}{3}$
16482 (Ind. Mus.) ...	220 ,,	7 ,,	$31\frac{3}{7}$
John's	320 ,,	9 ,,	$35\frac{5}{9}$

Prof. Aiyar's specimen differs in colouration both from the other specimens and from the published description. It is markedly *melanistic*, being dark slate-coloured. The throat and the anterior part of the belly are also dark, and the white edgings on the scales on the sides and the belly are inconspicuous. The anal region is black, but as the region of the belly anterior to it (as a matter of fact, the whole ventral region) is darkish, it does not stand out as a definite patch as in other specimens. The lower surface of the tail is pinkish, and there is a dark patch just behind the subcaudal scute.

As a result of the present study, the following description for the species may be proposed :

Snout acutely pointed; *rostral* smooth above, not keeled, about $\frac{1}{3}$ the length of the shielded part of the head, separating the prefrontals for half their length, the portion visible less than the distance between it and the hinder part of the frontal; *frontal* longer than broad, as long as the parietals; diameter of the *eye* $\frac{1}{3}$ to $\frac{2}{5}$ the length of the ocular shield; *scales* in 17 rows; *ventrals* 132-151, about $1\frac{1}{2}$ times as broad as the adjacent scales; *caudals* 5-7; *caudal disc* as long as the shielded part of the head, almost flat, covered with spicules.

Yellowish-brown to shining dark slate-coloured, the scales on the sides and belly edged with whitish (edgings less conspicuous in melanistic specimens); on the throat and fore part of the belly almost completely whitish (even this region dark in melanistic specimens); anal region marked out by a dark patch in specimens in which the ground colour is not dark slate; lower surfaces of the tail yellow or pinkish.

Maximum length 320 mm., diameter varying from $6\frac{1}{2}$ to 9 mm.

Range. Travancore (Trivandrum, Mahendragiri, Pirmed, Ernakulum, Chenganacherry). Found at sea-level and in the hills to about 4,000 ft.

In the end, it is my pleasant duty to thank Dr. Baini Prashad, Prof. Padmanabha Aiyar and Prof. C. John for the specimens examined; Dr. Baini Prashad for the loan of two volumes from the Indian Museum library; and Dr. Malcolm Smith not only for sending me his unpublished description of the species, but also for many acts of friendship and kindness during the past years.

THE EARLY STAGES OF INDIAN LEPIDOPTERA.

BY

D. G. SEVASTOPULO, F.R.E.S.

SUPPLEMENTARY INTRODUCTION.

These descriptions were originally prepared for the *Entomologist's Record*, but lack of space entailed considerable delays in publication, and it was eventually decided that the series could be handled more advantageously in India. The following had, however, already appeared:—

Introduction—1933, xlv, p. 136.
Byasa aristolochiae F., *aristolochiae*—1933, xlv, p. 137.
Chilasa clytia L., *clytia*—1933, xlv, p. 137.
Huphina nerissa F., *evagete* Cr.—1933, xlv, p. 138.
Catopsilia crocale Cr.—1933, xlv, p. 148.
Terias hecabe L., *hecabe*—1933, xlv, p. 148.
Pareronia valeria Cr., *hippia* F.—1933, xlv, p. 149.
Danais chrysippus L.—1933, xlv, p. 149.
Euploea core Cr., *core*—1935, xlvii, p. 18.
Elymnias hypermnestra L., *undularis* Drury—1935, xlvii, p. 18.
Euthalia garuda Moore, *suddhodana* Fruhs.—1935, xlvii, p. 49.
Rathinda amor F.—1935, xlvii, p. 49.
Suastus gremius F., *gremius*—1936, xlviii, p. 19.
Udaspes folus Cr.—1936, xlviii, p. 19.
Dasychira mendosa Hbn.—1936, xlviii, p. 58.
Orgyia postica Wlk.—1936, xlviii, p. 59.
Porthesia (*Euproctis*) *scintillans* Wlk.—1936, xlviii, p. 99.
Rhyncholaba acteus Cr.—1937, xlix, p. 80.
Natada suffusa Moore—1937, xlix, p. 81.
Polytela gloriosae F.—1937, xlix, p. 124.
Ophiusa coronata F.—1937, xlix, p. 125.
Buzura suppressaria Guen.—1938, l, p. 76.
Agathia laetata F.—1938, l, p. 77.
Sylepta derogata F.—1938, l, p. 77.

and I am much obliged to the Editors of the *Entomologist's Record* for permission to republish them here.

In some of these I have added further references and also names of food-plants; such additions are enclosed in brackets.

Since writing the original introduction, a considerable advance in our knowledge of the early stages has been made by the publication of Vol. v in the *Fauna of British India*, Moths—Sphingidae by Bell and Scott; this contains descriptions and, in many cases coloured figures or photographs, of all the then known Indian Sphingid larvae.

Calcutta, 4-vii-38.

INTRODUCTION.

The more easily obtained books on Indian Lepidoptera are, I have found, of very little help in the identification of the early stages; a large number of the few descriptions appearing in Sir George Hampson's Moths in the *Fauna of British India* and in the Indo-Australian section of Seitz's *Macrolepidoptera of the World* are vague, incomplete and even inaccurate, whilst Evans, in his *Identification of Indian Butterflies*, ignores the early stages altogether.

I have, therefore, made a point of recording brief descriptions of the various larvae that have passed through my hands in the hope that they may prove of use to other entomologists working in India.

When numbering the somites I have in all cases ignored the head, the 1st somite is, therefore, the one immediately behind the head, i.e. the first thoracic somite. Further, in spite of the fact that most of the descriptions are noted as being made from single larvae, they have all been checked with other examples so that there is no danger of an aberration masquerading as the usual form. There is, however, always the possibility of some of these descriptions applying to local forms only.

In cases where the description given in the four volumes of Moths by Sir George Hampson in the *Fauna of British India* or in the English Edition of the Indo-Australian section of Seitz's *Macrolepidoptera of the World* is particularly incomplete or misleading, I have added it to mine with the reference 'Hampson' or 'Seitz' as the case may be.

London, 7-vii-33.

RHOPALOCERA.

PAPILIONIDÆ.

Byasa aristolochiae F., *aristolochiae*.

Moore, *Lep. Ind.*, v, 178, pl. 442, figs. 1, 1a-1c. 1901-03.

(Moore, *Lep. Ceyl.*, i, 151, pl. 57, figs. 2a, 2b. 1880-81.)

Head and legs black. Body velvety black, the 6th somite with a white transverse band. The skin between the somites dark purplish crimson. 1st to 3rd somites each with eight coral red fleshy tubercles, the dorsal four on the 1st somite being very much smaller than the others. 4th to 10th somites each bearing six of these tubercles, those on the 6th being white, except the lowest one which is red. 11th and 12th somites with four tubercles. Osmeterium yellow.

Pupa fawn, very like a curled dead leaf. Thorax keeled with five white lines anteriorly and two posteriorly diverging from the keel. Wing cases darker brown and developing into a lobe anteriorly. The first three abdominal somites each with a white lateral U-shaped line. 4th to 7th abdominal somites each bearing a pair of conspicuous rounded lobes. Suspended by a girdle and tail pad of dark brown silk.

Food-plant—*Aristolochia* sp.

Described from a full fed larva found in Calcutta 8-x-31, pupated 12-x-31 and a female emerged 26-x-31.

Seitz does not mention the number of the tubercles nor the intersegmental colour of the larva and omits the colour of the pupa.

Chilasa clytia L., *clytia*.

(Moore, *Lep. Ceyl.*, i, 153, pl. 57, fig. 1b. 1880-81.)

(Moore, *Lep. Ceyl.*, i, 154, pl. 56, fig. 2b. 1880-81.)

(Moore, *Lep. Ind.*, vi, 84, pl. 502, figs. 1, 1a-1b. 1903.)

Moore, *Lep. Ind.*, vi, 89, pl. 506, figs. 1, 1a-1d. 1903.

Head and legs black. Ground colour black. A wide cream dorsal stripe from the 1st to the 9th somite, a cream lateral stripe from the 1st somite joining the dorsal stripe on the 7th and forming a trident, and a cream lateral stripe extending backwards from the 10th somite. A subdorsal series of fleshy black tubercles with a rose pink spot at the base of each. A double lateral series of rose pink spots, the upper complete and the lower with spots on the 3rd, 4th, 5th, 7th, 8th and 9th somites only. The osmeterium blue.

Pupa like a broken piece of stick, mottled with various shades of brown. Cylindrical, the last four abdominal somites hollowed out below. Thorax not keeled but projecting forward over the head which is truncate. Supported by a girdle and tail pad of dark brown silk.

There is no difference between the type and v. *dissimilis* in the early stages.

(Food-plant—*Alseodaphne semicarpifolia* Nees (Laurineae).)

Described from a full fed larva found in Calcutta 20-iv-31, pupated 23-iv-31 and a female emerged 4-v-31.

Seitz does not mention the cream-coloured markings and states that the 'fork on the neck' (osmeterium?) is pale-coloured.

(In my original description I omitted to mention that the first three tubercles of the subdorsal series are double, the additional ones being slightly smaller.)

Zetides agamemnon L., *agamemnon*.

Moore, *Cat. Lep. Mus. E.I.C.*, i, 114, pl. 3, figs. 9, 9a. 1857.

Moore, *Lep. Ceyl.*, i, 145, pl. 63, fig. 2a. 1880-81.

Davidson and Aitken, *Journ. Bom. Nat. Hist. Soc.*, v, 363. 1890.

Moore, *Lep. Ind.*, vi, 7, pl. 470, figs. 1, 1a-1c. 1903.

Jordan Seitz, *Indo-Austr. Rhop.*, 101.

Head green. Body green with darker indistinct oblique stripes. Spiracles black. Shape thickened from head to 3rd somite then tapering. The 1st and 2nd somites each with a small black subdorsal spine, the 3rd with a similar but slightly larger spine with an orange ring round the base. Anal plate with a pair of spines. Osmeterium pale green and, when once protruded, not withdrawn for some time. It is directed forward in a horizontal plane rather than above the head as in most Papilionid larvae. When at rest the larva bears a strong resemblance to a large green Pentatomid bug and this is increased when it is alarmed as the protruded osmeterium then mimics the bug's antennae.

Pupa pale green. Thorax with a white dorsal line, which divides on the first abdominal somite and joins again at the base of the cremaster. Thorax produced in front into a blunt horn tipped with brown and this colour continues as a margin along the outer edge of the wing cases. Head obtuse.

Moore, in *Lep. Ceyl.*, gives *Magnoliaceae* and *Anonaceae* as food-plants.

Described from a full fed larva found at Peshoke (2,500 ft. Darjeeling District) 30-xii-36, pupated 4-i-37 and a male emerged 2-ii-37.

Bingham, quoting Davidson and Aitken, describes the larva as having four pairs of spines. This is a little misleading as the spines on the anal somite are green and quite different to the black spines on the thoracic somites.

PIERIDÆ.

Huphina nerissa F., *evagete* Cr.

Moore, *Lep. Ceyl.*, i, 136, pl. 53, fig. 1b. 1880-81.

Bell, *Journ. Bomb. Nat. Hist. Soc.*, x, 574. 1897.

Typical Pierid larva of a dark velvety green. Very like *Pieris rapae*.

Pupa very like that of *Pieris rapae* in shape. Two colour forms, one green with head, thoracic keel and a triangular patch on each side of the metathorax pale brown. The other with the ground colour darker and similar markings in paler brown.

Food-plant—*Capparis* sp.

Described from a full fed larva found in Calcutta 22-xi-30, pupated 24-xi-30 and a male emerged 5-xii-30.

Catopsilia crocale Cr.

Moore, *Lep. Ceyl.* i, 122, pl. 48, fig. 1b. 1880-81.

Bell, *Journ. Bomb. Nat. Hist. Soc.*, x, 570. 1897.

(De Nicéville and Kuhn, *J.A.S.B.*, p. 271, pl. 1, figs. 5a, 5b. 1898.)

Typical Pierid larva. Head green with minute black dots. Skin of the body very rough, green with minute black dots. A white spiracular line above which is a black dotted one and below an olive green stripe. Ventral surface whitish green.

Pupa boat-shaped with the thorax slightly keeled and the head produced to a point. Two colour forms. The one apple green with a yellow line on the thoracic keel and another lateral one running from the head along the dorsal edge of the wing case to the tail. The other form grey green, a dark brown dorsal line and a pale lateral line. The wing cases and the sides of the abdomen suffused with dark brown striae. Suspended by a girdle and tail pad.

Food-plant—*Cassia* sp.

Described from two full fed larvae found in Calcutta 7-ix-31, pupated 9-ix-31 and two females emerged 14-ix-31.

Seitz describes the pupa as having black tubercles.

Terias hecabe L., *hecabe*.

Moore, *Lep. Ceyl.*, i, 118, pl. 45, fig. 1c. 1880-81.

Bell, *Journ. Bomb. Nat. Hist. Soc.*, x, 570, pl. 6, figs. 5, 5a. 1897.

Typical Pierid larva, green with a white spiracular line. The skin rough.

Pupa with thorax slightly keeled. Very variable in colour. Some grass green with a dark dorsal line and a black spot at the base of the wing cases, others have in addition a square black subdorsal spot on the 2nd abdominal somite and others again have the wing cases more or less suffused with black and black lateral suffusion.

Food-plant—*Cassia* spp.

Described from a batch of nine full fed larvae found in Calcutta 17-x-31, pupated 19-x-31 and five males and four females emerged 24-x-31.

Seitz states that the larva has a large black head, this was not the case with my specimens.

Terias blanda Bsd., *silhetana* Wall.

Bell, *Journ. Bom. Nat. Hist. Soc.*, x, 571, pl. 6, figs. 6, 6a. 1897.

Fruhstorfer Seitz, *Indo-Austr. Rhop.*, ix, 169.

Head large and black. Body yellow green, the anterior portion usually rather darker owing to the contents of the crop. A barely distinguishable pale lateral stripe. The appearance is very different to that of *T. hecabe,* whose larva is of a far bluer green with a distinct white lateral line and a green head. Gregarious.

Pupa with the thorax compressed and the wing cases forming a deep keel. Ground colour yellowish, almost obscured by black suffusion, and a black dorsal line. Suspended by the tail and a longish girdle. A point of interest is that while all my *T. hecabe* larvae have suspended themselves for pupation from the lid of their tin, the great majority of the *blanda* larvae pupated on the stems of their food-plant.

Food-plant—*Cassia* spp.

Described from a batch of full fed larvae found at Peshoke (2,500 ft. Darjeeling District) 1-i-37, one of which pupated 13-i-37 and a female emerged 26-i-37.

Pareronia valeria Cr., *hippia* F.

Bell, *Journ. Bomb. Nat. Hist. Soc.*, x, 573. 1897.

Typical Pierid larva, bright green with a pale dorsal line. Legs pinkish. A lateral fawn coloured blotch of granular appearance on the 4th and 11th somites. A series of oblique dark lateral lines from the 5th to the 10th somite. Anal plate projecting and slightly forked.

Pupa compressed laterally. Wing cases very large. The head produced into a beak forming an almost unbroken curve with the dorsum. Colour whitish green with a dark dorsal and a pale lateral line. 2nd abdominal somite with a pair of small black dots. Wing cases with a red central and a series of white submarginal spots.

Food-plant—*Capparis* sp.

Described from a full fed larva found in Calcutta 10-i-31, pupated 12-i-31 and a female emerged 22-i-31.

Seitz describes the larva as being green but mentions no markings. He compares the shape of the dorsal distal margin of the pupa to that of an enormous sun helmet.

DANAIDÆ.

Danais limniace Cr., *mutina* Fruh.

Moore, *Lep. Ceyl.*, i, 4. 1880-81.

Moore, *Lep. Ind.*, i, 30, pl. 6, fig. 1. 1890-92.

Head very pale green with two black rings. Ground colour very pale green, each somite with four transverse black lines, the second being considerably broader than the others and dividing into two laterally. A yellow sublateral band edged above with black. A pair of long fleshy filaments on the 2nd and a pair of short on the 12th somite, coloured pale green with black tips and with a black line along the anterior and posterior edges. Legs and prolegs pale green ringed with black. Ventral surface with indistinct transverse black lines.

Pupa green with the following brilliant golden markings. A beaded dorsal band along the posterior edge of the 4th abdominal somite. A dorsal and a lateral spot on the 3rd and a dorsal spot on the 2nd abdominal somite. A subdorsal and a lateral spot on the metathorax and a dorsal and lateral spot on the mesothorax. A double spot on the eye. A spot at the base of the wing case, a subbasal spot and a post median series of two to four spots placed in a curve. A spot on the edge of the wing case in continuation of the dorsal band. A very short line at each end of the transverse dorsal stripe, the cremaster and a U-shaped mark on the ventrum black. Suspended by the cremaster under a leaf.

Bingham gives *Asclepias* and *Calotropis* as food-plants.

Described from a full fed larva and pupa found in Calcutta 25-viii-35, from which a male emerged 26-viii-35.

Danais chrysippus L.

(Moore, *Lep. Ceyl.*, i, 7, pl. 3, fig. 1b. 1880-81.)

Moore, *Lep. Ind.*, i, 36, pl. 8, fig. 1. 1890-92.

(Bingham, *Fauna Brit. Ind.*, Butterflies, i, 11. 1905.)

Head grey with two black rings. Ground colour grey, 1st to 11th somites each with a black transverse central stripe and a black line on each side. The 2nd to 11th somites each with a pair of subdorsal elongate yellow spots. 12th somite with a transverse yellow stripe edged with black. 2nd, 5th and 11th somites with a pair of subdorsal black filaments, those on the 2nd longest and pointing forward, the base of the pair on the 5th somite reddish. A yellow lateral stripe. Legs black. Claspers black banded with grey. Anal plate black. Ventral surface blackish with a few grey dots.

Two pupal forms, the one blue green, the other pinkish buff. Both with a golden spot on the eye, one in the middle of the wing case, one at its origin and two near the lateral edge of the metathorax. The abdomen with a dentate ridge on the 4th somite, black anteriorly and gold posteriorly. Cremaster black. Suspended by the tail from any suitable support. The green form is usually found among leaves, the buff form in other situations.

Food-plant—'Ak' (*Calotropis procera* R. Br.).

Described from a full fed larva found in Calcutta 27-x-31, pupated 29-x-31 and a male emerged 6-xi-31.

Seitz mentions a wax yellow pupal form but I have never seen it.

Euploea core Cr., *core*.

(Moore, *Lep. Ind.*, i, 81, pl. 23, figs. 1, 1a. 1890-92.)

Head shining black edged with white, a white mark above the jaws and a white line running from the side of the mandibles to the median suture forming a triangle. Body chocolate brown ringed with white, a brick red line edged below with white along the spiracles, which are black. Paired black subdorsal fleshy filaments on the 2nd, 3rd, 5th and 11th somites, those on the 2nd being longest. A transverse black line on the 2nd and 3rd somites joining the bases of the filaments. Ventral surface dark brown. Anal plate black. There is another form of the larva in which the chocolate and white markings are replaced by a dark and light shade of purplish grey.

Pupa brilliantly gilded with fawn coloured markings. Cremaster and last abdominal somite black. Suspended from the underside of a leaf and somewhat resembling a drop of water shining in the sun. The fawn markings are more pronounced in those pupae that develop in shady places.

Food-plant—Oleander and Peepul (*Ficus religiosa* Linn.), vide *Entomologist*, lxvi, p. 118.

Described from a full fed larva found in Calcutta 30-ix-30, pupated 5-x-30 and a male emerged 12-x-30.

Seitz mentions an emerald green form of pupa with a brilliant metallic gloss on the head, but I have never come across it.

SATYRIDÆ.

Elymnias hypermnestra L., *undularis* Drury.

(Bingham, *Fauna Brit. Ind.*, Butterflies, i, 171. 1905.)

Head square, pinkish brown outlined with yellow, and divided above into a pair of horns. Skin rough and pubescent. Body bright apple green with a fine double yellow dorsal line, a subdorsal yellow line bearing a red spot on the 8th, 9th and 10th somites and a blue dot on the 8th and 9th. A thin yellow line running along just above the spiracles with another below it. The last somite produced into a pair of processes about $\frac{1}{4}$ inch long, yellow at the base and shading into reddish at the apex. In some examples the red dorsal spots are obsolete.

Pupa apple green. The head divided into two short horns marked at the base with pink. The upper edge of the wing cases marked with pink and with a pink spot in the cell. Thorax keeled, the keel yellow outlined in pink, with two subdorsal pink spots. The abdomen with a subdorsal line broken up into yellow and pink spots. Trace of a similar lateral line. The last abdominal somites strongly curved so that the pupa, instead of hanging, lies parallel to the leaf to which it is attached. Fixed to the underside of a leaf of the food-plant by the cremaster.

Food-plant—Palms of various species.

Described from a full fed larva found in Calcutta 14-x-30, pupated 18-x-30 and a female emerged 26-x-30.

Seitz does not mention the long anal processes.

NYMPHALIDÆ.

Euthalia garuda Moore, *suddhodana* Fruhs.

(Moore, *Cat. Lep. Mus. E.I.C.*, i, 186, pl. 6, figs. 2, 2a. 1857.)

(Moore, *Lep. Ind.*, iii, 115, pl. 234, figs. 1, 1a-1d. 1896-99.)

Head green, body green with a pale dorsal stripe and a pale mauve transverse line on each somite. A series of eleven feathery scoli, about $\frac{3}{8}$ths of an inch long, arising subdorsally, the first pair pointing forwards, the 2nd to 10th pairs sideways and the 11th pair backwards.

Pupa green. The head lobed with a brown spot on each projection. A lateral and a dorsal brown spot on the thorax, a gilt and brown line between the 3rd and 4th abdominal somites dorsally. Shape, ventral surface flattish; thorax and first three abdominal somites flat with a median keel and rising to a point, the posterior somites with a slight median keel.

Food-plant—Mango (*Mangifera indica* Linn.).

Described from a full fed larva found in Calcutta 16-i-32, pupated 19-i-32 and a female emerged ?-ii-32.

Seitz describes a form of the larva in which the transverse lines are yellow.

Aglais cashmirensis Koll., *aesis* Fruhs.

Head black with rufous bristly pubescence. Ground colour black sprinkled with yellow specks, which are thickest on each side of the dorsal line. 1st somite spineless, 2nd and 3rd each with four (subdorsal and lateral) and 4th to 11th somite each with seven (sublateral, lateral, subdorsal and dorsal) branched spines. 12th and 13th somites with the subdorsal spines only. Legs black. Prolegs tinged with green. When young lives gregariously in a web.

Pupa with head bilobed, thorax rising to a point and with six short subdorsal paired spines along the abdomen. Colour pinkish stone colour, some being darker and greyer. Slight gilding on the posterior portion of the thorax and on the first pair of abdominal spines. In some specimens the gilding extends over the whole body.

All stages are very like the European *A. urticae* L.

Food-plant—Nettle.

Described from one of a batch of full fed larvae found in Darjeeling 10-v-35, pupated 12-v-35 and a male emerged 28-v-35.

LYCAENIDÆ.

Cosmolyce (*Lampides*) *boeticus* L.

Bingham, *Fauna Brit. Ind.*, Butterflies, ii, 432. 1907.

Head retractile, brown. About half an inch long of typical Lycaenid woodlouse shape. Varies in colour from pale to dark green, some specimens being suffused with purplish. A dark dorsal and a pale lateral line. Each somite with a dark subdorsal oblique line directed backwards. The divisions between the somites shallow. The gland and tubercles not very noticeable.

Pupa bone colour, the head and thorax slightly darker and shaded with black. A dark dorsal line. Each abdominal somite with four subdorsal black spots, a pair on each side of the dorsal line. Anal end rounded. Supported by a girdle of silk in a spun together leaf.

Food-plant—Lupins and Peas, preferring the flowers and seeds. De Nicéville records it feeding on the flowers and pods of *Crotalaria striata* DC. and there are probably few leguminous plants on whose flowers and seeds it would not feed.

Has the common Lycaenid habit of devouring its pupating fellow larvae. Imagines emerge about 9 a.m.

Described from a number of full fed larvae found in Calcutta 1-ii-35, one of which pupated 8-ii-35 and a female emerged 17-ii-35.

Bingham, quoting De Nicéville, describes the larva as being pale, dull green without markings except for the dark dorsal line. He also describes the pupa as being pale yellowish green.

Pratapa deva Moore, *lila* Moore.

Seitz Seitz, *Indo-Austr. Rhop.*, ix, 971.

Pupa darker or paler olive brown. The following chalky white marks, a short streak on each side of the head, a trident-shaped mark on the metathorax with the handle pointing forwards, the whole of the abdomen with the exception of the dorsum of the 1st somite and a lateral stripe. Resembles a bird dropping. Suspended by the tail without any girdle.

Described from a number of pupae found on the trunk of an orange tree at Peshoke (2,500 ft. Darjeeling District) 30-xii-36, from one of which a male emerged 13-i-37.

A pupating larva found at the same time was pale pinkish ivory in colour with the thoracic somites humped. It is said to feed on *Loranthus*.

Rathinda amor F.

Head retractile. Ground colour bright green, olive green or dull purple. The green forms with a brown transverse band on the 4th and a brown dorsal patch on the 6th to 8th somites, the purple forms with the same markings a little darker than the ground colour. A white lateral line from the 5th to 10th somite. The 2nd and 3rd somites with a pair of subdorsal horn-like projections, the pair on the third somite being the longer. A single dorsal projection on the 4th somite. The 5th somite bearing a long dorsal and a long lateral projection. The 6th to 9th somites each bearing a dorsal projection, that on the 6th very short, the 7th and 8th slightly longer and that on the 9th long. The 10th somite with a short dorsal projection and a long lateral one.

Pupa shaped like that of a Syrphid, green with a brown dorsal patch.

Food-plant—A cultivated garden shrub with bright scarlet flowers (*Ixora* sp.). The larvae prefer the flowers and the young berries to the leaves.

Described from full fed larvae found in Calcutta 10-vii-32, pupated 12-vii-32 and males and females emerged 20-vii-32.

Seitz described the larva as being 'Green with purplish red cones of different lengths'.

GRYPOCERA.

Suastus gremius F. *gremius*.

Kershaw, *Butt. Hong Kong*, 125, pl. 14.

De Nice., *Ind. Mus. Notes*, i, 9.

Head brown with pale central and lateral stripes. Body glaucous green with a dark dorsal line. Spiracles black. Anal plate large and broad, the body flattened posteriorly.

Food-plant—Palms of various species on which the larva lives in a turned over leaf.

Pupa very moth-like, enclosed in a cell made from a spun together leaf and covered with a waxy powder. Yellow green with the last somite and cremaster reddish brown. Thorax darker green with a lateral reddish spot anteriorly.

Described from a full fed larva found in Calcutta 11-xii-31, pupated 16-xii-31 and a male emerged 10-i-32.

Udaspes folus Cr.

Kershaw, *Butt. Hong Kong*, 136-37, pl. 14.

Larva slug-like. Head dull black, heart-shaped and small for the size of the larva. Thoracic somites very slender giving the appearance of a neck. Colour bluish green due to the contents of the intestines and the blood, the skin itself being unpigmented. Anal plate very broad and flat. A white mealy blotch ventrally between each pair of claspers.

The larva lives in a turned over leaf on various sorts of Monocotyledons.

Pupa very pale green, torpedo-shaped with the head produced to a long snout. Attached by a girdle and the cremaster in a waxy cell. During the pigmentation of the developing imago, the eyes become red but later darken to black.

Described from a full fed larva found in Calcutta 17-x-30, pupated 20-x-30 and a male emerged 11-ii-31.

HETEROCERA.

ZYGAENIDÆ.

Trypanophora semihyalina Koll.

Moore, *Lep. Mus. E.I.C.*, ii, pl. xiv, fig. 6.

Hamps., *Fauna Brit. Ind.*, Moths, i, 249. 1892.

Jordan Seitz, *Indo-Austr. Bombyces*, x, 14.

Head brown and retractile. Ground colour dark brown, a lateral yellow patch extending back from the 9th somite. A series of small subdorsal tubercles, those on the 2nd somite red and double, on the 3rd black and double, on the 4th to 9th black and single and on the 10th yellow. A sublateral series of tubercles, those on the 2nd and 3rd somites red and double, on the 4th to 6th red and single, on the 7th and 8th black and on the 9th to 11th yellow. Spiracles black. Ventral surface and claspers orange red.

Pupa yellow with the thorax a little darker. Enclosed in a thin cocoon of papery white silk.

Food-plant—*Lagerstroemia indica* Linn. and *L. Flos-reginae* Retz.

Described from a full fed larva found in Calcutta 26-x-31, pupated 29-x-31 and a female emerged 12-xi-31.

ARCTIIDÆ.

Roeselia fola Swinh.

Head yellowish. The body thickly clothed with dark hair. A remarkable feature is that the head capsules are not got rid of at each ecdysis but adhere one to the other, a full grown larva often carrying a chain of five or six. Before fully mature the larva is covered with pale pink fluff, this is shed during the last instar revealing the dark hair.

Pupa reddish brown, rather long. Enclosed in a cocoon spun along a twig and composed of silk, hair and woody fragments.

Food-plant—*Quisqualis indica* Linn.

Described from a full fed larva found in Calcutta 23-x-31, pupated 27-x-31 and a female emerged 3-xi-31.

Aganais ficus F.

Hamps., *Fauna Brit. Ind.,* Moths, i, 504. 1892.

Seitz Seitz, *Indo-Austr. Bombyces*, x, 225.

Penultimate instar. Head and legs brownish black. 1st somite orange with a black median patch. The rest of the body with a black median line, a white dorsal stripe, a black subdorsal stripe with transverse white lines and an orange lateral stripe. A pair of dorsal black spots on each somite. The 9th somite entirely black. Ventral surface orange red.

Final instar. Head and legs brownish black. Ground colour blackish, the ventral surface and claspers orange red. A lateral yellow patch on the 5th and 9th somites. 1st to 3rd somites each with eight red papillae bearing white hairs. 4th to 11th somites each with ten similar papillae. Some specimens have fine white transverse lines on the dorsum and a broken pale yellow spiracular line.

Pupa reddish brown, very noctuid in shape and enclosed in an earthen cocoon on the surface of the ground.

Food-plant—Peepul (*Ficus religiosa* Linn.).

Described from a batch of larvae found in Calcutta 6-v-32, pupated 13-v-32 and males and females emerged 24-v-32.

Asota caricae Bsd. (*alciphron* Cr.).
Moore, *Lep. Ceyl.*, ii, 52, pl. 102, fig. 1b. 1882-83.
Hamps., *Fauna Brit. Ind.*, Moths, i, 502. 1892.
Seitz Seitz, *Indo-Austr. Bombyces*, x, 227.

Head black marked behind with red. 1st somite with a red transverse band and a black median patch. A black median line, a white subdorsal stripe with a black dot on each somite, a black lateral stripe and an interrupted white spiracular line. Last somite reddish. Ventral surface dark brown. Claspers pinkish. Clad with sparse white hairs. The larvae are gregarious and very active falling to the ground at the slightest touch.

Pupa reddish brown, very noctuid in appearance. Enclosed in an earthen cocoon on the surface of the ground.

Food-plant—*Ficus hispida* Linn.

Described from a full fed larva found in Calcutta 16-i-32, pupated 19-i-32 and a male emerged 5-ii-32.

Hampson describes the larva as being 'black above, brown below; two dorsal white bands, a subdorsal black speck on each somite; a series of lateral black specks; sparse black hairs; the head red'.

Spilarctia obliqua Wlk.
Roths. Seitz, *Indo-Austr. Bombyces*, x, 243 (ab. *dahlbergiae* Moore).

Ova spherical, pale green. Laid in large batches.

Young larva with the head black. Ground colour yellowish, the first three and last three somites marked with black. A subdorsal blackish stripe. Hair pale on the pale somites and mixed with black on the black ones. Legs and claspers black. After the 3rd moult there is a series of indistinct pale oblique lateral stripes and the posterior portion of the pale somites is dark grey.

Full grown larva with the head black. Ground colour dark grey, the 1st to 3rd and 11th to 13th somites black with the intersegmental areas whitish. 4th to 10th somites with anterior half rufous orange. A pale dorsal stripe. A sublateral series of pale oblique stripes. The hair pale except on the 1st to 3rd and 11th to 13th somites, where it is mixed with black. Legs and claspers black.

Pupa of the usual Arctiid shape and dark red in colour, in a cocoon of brownish silk mixed with larval hair.

Food-plant—Sunflower, *Antirrhinum* and probably many other low plants.

Described from a number of larvae bred from ova in Calcutta, one of which pupated 26-iii-38 and a male emerged 2-iv-38.

Seitz describes the larva of ab. *dahlbergiae*, Moore as 'black, very long haired'. My larvae gave both ab. *dahlbergiae* and typical imagines and there was no apparent difference in the larvae.

Utetheisa pulchella L.
Hamps., *Fauna Brit. Ind.*, Moths, ii, 55. 1894.

Ova pale yellow, spherical with the base flattened slightly. Laid in lines with a space between each ovum. Hatch on the fourth day.

Larva—Head rufous. Body blackish with a white dorsal stripe interrupted in the middle of each somite by a transverse black edged reddish bar. A pale lateral stripe and a white sublateral line, each with a series of black centred orange tubercles giving rise to a white hair. Each somite with two black tubercles on each side of the dorsal stripe, the anterior pair being rather closer together, these each give rise to a black hair except those on the 1st to 3rd and 10th to 12th somites, which have a white and somewhat longer hair. Ventral surface greenish with a blackish lateral stripe. Legs and prolegs marked with blackish. The ground colour fades to a greyish tint prior to each moult and the markings are then more noticeable.

Pupa in a thin cocoon of white silk. Chestnut brown, the thorax blackish except for a central stripe, a blackish transverse stripe on each of the abdominal somites. Wing cases striped with black along the veins. Leg and antenna sheaths black striped. In some pupae the black markings on the thorax and wing cases are less pronounced.

Food-plant—Dahlia, but this may not be a natural one. South in *Moths of the British Isles* gives *Myosotis* and records that the larva is said not to feed in the absence of sunshine. Mine did not do this.

Described from a full fed larva from a number bred from ova in Calcutta, pupated 30-iii-38 and a female emerged 5-iv-38.

Hampson gives the following rather incomplete description:—'Larva dark grey, with a dorsal white band and subdorsal series of red spots; head yellow.'

Argina argus Koll.
Moore, *Lep. Ceyl.*, ii, 69, pl. 105, figs. 1b, 1c. 1882-83.
Hamps., *Fauna Brit. Ind.* Moths, ii, 51. 1894.
Seitz, *Pal. Bombyces*, ii, 74.

Head reddish brown, black at the sides. Body blackish with a broad white dorsal stripe. An interrupted red sublateral line from the 4th to the 10th somite. A few hairs.

Pupa in a slight web. Yellowish brown with the following black markings. On the abdomen a large dorsal and subdorsal spot on each somite and a double median and broad lateral stripe ventrally. On the thorax a U-shaped mark. On the wing cases a costal stripe, a broad median streak dividing at the outer margin into four and a broad stripe along the inner margin. Leg sheaths streaked with black.

Food-plant—A leguminous plant with large yellow flowers. The larva bores into the pods, which are pubescent, thick and about an inch and a half long, eating the unripe seeds and leaving a conspicuous hole.

Described from a number of larvae found at Peshoke (2,500 ft. Darjeeling District) 26-xii-36, one of which pupated 10-i-37 and a male emerged 29-i-37.

Hampson's description is 'Larva purple black, with a few dorsal hairs; head and a lateral line from 4th to 10th somites reddish; a dorsal series of transverse white streaks.'

LYMANTRIIDÆ.

Dasychira mendosa Hbn.

Moore, *Lep. Ceyl.*, ii, 96, pl. 115, fig. 4b. 1882-83.

(Hamps., *Fauna Brit. Ind.*, Moths, i, 452. 1892.)

(Strand Seitz, *Indo-Austr. Bombyces*, x, 292.)

Head, legs and claspers crimson. 1st somite white with four longitudinal crimson stripes and bearing subdorsal pencils of dark grey hair pointing forward. 4th to 7th somites with short dorsal tufts of greyish white hair, the skin between these somites velvety black. A lateral tuft of white hair on the 4th and another of plumose black and white hair on the 5th somite. A dorsal pencil of dark grey hair pointing backward on the 11th somite. Ground colour grey, a lateral series of crimson spots on a white line. 4th to 11th somites with a subdorsal series, the 8th to 10th bearing in addition a dorsal pair, of red spots. An interrupted white median line bearing a red spot on the 8th and 9th somites.

Pupa dark brown dorsally, the first three abdominal somites with patches of golden brown pubescence. Wing cases and ventral surface greenish. Enclosed in a cocoon of white silk mixed with larval hairs.

Food-plant—*Lagerstroemia indica* Linn. (Crape Myrtle).

Described from a full fed larva found in Calcutta 9-xii-31, pupated 15-xii-31 and a female emerged 23-xii-31.

Hampson describes another form of the larva with the ground colour blackish and the dorsal tufts bright yellow. All my specimens, however, have been of the grey form with greyish white tufts.

Varmina indica Wlk.

Hamps., *Fauna Brit. Ind.*, Moths, i, 435. 1892.

Head and legs brown. Ground colour rufous with a paler dorsal line and a black subdorsal and lateral stripe. The skin on the dorsum between the 1st, 2nd and 3rd somites also black. 1st somite with a dorsal fringe of pale hair projecting forward over the head and a pencil of long grey hair arising subdorsally. 2nd to 10th somites each with a subdorsal tuft of pale yellowish hair and a slighter lateral tuft springing from a reddish tubercle. Each tuft with one or two hairs very much longer than the others. 11th somite with a dorsal pencil of dark grey hair, 12th somite with a few scattered long grey hairs. Spiracles white ringed with black. A black stripe running from each spiracle to the anterior edge of the somite, where it joins the lateral stripe. Ventrum with an interrupted black stripe.

Another larva was completely black with white spiracles.

Pupa dark reddish brown in a cocoon of thin yellowish silk mixed with larval hairs.

Food-plant—A shrub rather like the English Dogwood.

Described from a full fed larva found in Darjeeling 15-v-35, pupated 21-v-35 and a female emerged 7-vi-35.

Hampson describes the larva as 'black, speckled with white and with dorsal and lateral tufts of hair arising from fulvous tubercles; the thoracic and anal somites with reddish tufts, the medial with grey, 4th and 11th somites with long dorsal black tufts.'

Orgyia postica Wlk.
Moore, *Lep. Ceyl.*, ii, 78, pl. 109, fig. 1b. 1882-83.
(Hamps., *Fauna Brit. Ind.*, Moths, i, 436. 1892.)
(Strand Seitz, *Indo-Austr. Bombyces*, x, 301.)

Head reddish brown. 1st somite with subdorsal pencils of long dark plumose hair projecting forward. Short dorsal tufts of yellow hair from the 4th to 7th somite. Lateral tufts of white hair on the 4th and 5th somites. A dorsal pencil of long brown hair on the 11th somite directed backwards. Ground colour blackish with a pale subdorsal line. A series of small lateral pinkish spots tufted with hair.

Pupa whitish, the thorax and first four abdominal somites dark brown. Enclosed in a cocoon of whitish silk mixed with larval hair.

Food-plant—*Lagerstroemia indica* Linn. (Crape Myrtle).

Described from a full fed larva found in Calcutta 15-i-32, pupated 18-i-32 and a male emerged 24-i-32.

Hampson describes the larva as 'yellowish, sparsely clothed with brown hair; one dorsal and two lateral brown bands; paired tufts of long brown hair on the 1st and 11th somites projecting forward and backward; lateral tufts of grey hair from 4th and 5th somites; dorsal tufts of yellow hair on 4th to 7th somites; the head red,' and this description is copied almost word for word by Seitz.

Perina nuda F.
Moore, *Lep. Ceyl.*, ii, 94, pl. 114, fig. 1b. 1882-83.
Hamps., *Fauna Brit. Ind.*, Moths, i, 486. 1892.

Head grey and pubescent. Ground colour pinkish grey. 1st somite with a red lateral tubercle tufted with grey hair and a dorsal pair of black or red spots. 2nd and 3rd somites with an olive green lateral band, bearing two pink spots on each somite. 4th and 5th somites each with a dorsal hump covered with short hair. A broad olive green dorsal band from the 4th somite backward. 4th to 11th somites each with a subdorsal blue spot ringed with black and bearing a few black bristles. A white dorsal papilla on the 9th and a red on the 10th somite. A series of lateral tubercles tufted with grey hair. Legs, prolegs and ventral surface whitish.

Pupa under a very slight web spun over the fold of a leaf. Head, wing cases and ventral surface whitish. Thorax yellow green with a chestnut coloured transverse band anteriorly, a dorsal chestnut stripe and a lateral series of five black spots. Abdominal somites bright green, all but the 3rd and 4th with a chestnut dorsal patch, which is edged laterally on the posterior somites with black. Tufted with golden yellow hair.

Food-plant—*Ficus* of various species. Moore gives Acanthads, but this seems unlikely.

Described from a full fed larva found in Calcutta 25-viii-35 pupated 27-viii-35 and a female emerged 31-viii-35.

Porthesia (*Euproctis*) *scintillans* Wlk.
(Moore, *Lep. Ceyl.*, ii, 86, 87, pl. 111, figs. 1b, 3a. 1882-83.)
(Btlr., *Ill. Het.*, vii, 123, pl. 138, fig. 10. 1889.)
(Hamps., *Ill. Het.*, ix, 77, pl. 175, fig. 12. 1893.)
Hamps., *Fauna Brit. Ind.*, Moths, i, 483. 1892.
Strand Seitz, *Indo-Austr. Bombyces*, x, 333.

Head yellow brown. Ground colour blackish. A pair of red tubercles tufted with hair on the 1st somite. A pale dorsal stripe from the 1st to the 3rd somite, the portion on the 3rd being yellow with a red central line. A black dorsal swelling on the 4th and another on the 5th somite, that on the 4th edged anteriorly and laterally and that on the 5th posteriorly with yellow. A yellow dorsal stripe from the 6th to the 10th somite with a red central line. A black dorsal swelling on the 11th somite. 4th to 10th somites with raised black lateral patches dotted with white.

Pupa. Yellowish brown, thorax and wing cases greenish. Abdominal somites with a subdorsal and lateral dark line. Enclosed in a thin cocoon of brown silk mixed with larval hairs.

Food-plant—*Lagerstroemia indica* Linn. (Crape Myrtle).

Described from a full fed larva found in Calcutta 18-x-31, pupated 22-x-31 and a male emerged 31-x-31.

Hampson describes three other forms of larva, but omits this, the only form I have seen. Seitz's description is as follows:—'Head and legs brown, head with two hair tufts on red tubercles. Dorsum white with a red streak, the third joint with a red tubercle, 4th and 5th joints with black hair tufts, penultimate joint with a black torus, last joint brown. On the sides greyish brown and red longitudinal stripes.' He does not give the food-plant.

LASIOCAMPIDÆ.

Metanastria hyrtaca Cr.
Moore, *Lep. Ceyl.*, ii, 148, pl. 141, fig. 1b. 1882-83.
Forsayeth, *Trans. Ent. Soc.*, pl. xv, figs. 3, 3a, b. 1884.
Hamps., *Fauna Brit. Ind.*, Moths, i, 410. 1892.

Head purplish grey brown, minutely speckled with darker. A dark brown median stripe divided into two above the mouthparts. Body purplish grey brown streaked and speckled with darker. 1st and 2nd somites with a dark brown dorsal stripe, narrow anteriorly and broadening posteriorly. 3rd to 11th somites each with a dorsal hexagonal dark brown blotch, the whole forming a chain, the blotch on the 8th somite rather paler in colour. A short lateral oblique dark streak on each somite. Except the 1st, each somite with four blue warts with dark hairs. The 2nd somite with a dorsal tuft, the anterior portion of short buff spatulate hairs, the posterior portion with longer black simple hairs, the skin between black. 3rd somite with a transverse fold, the skin of which is deep scarlet but which only shews when the larva is alarmed. Each somite with a lateral tubercle with a fan-shaped tuft of pale hair, immediately above which is a smaller tuft of buff coloured spatulate hair. Ventral surface black with yellow streaks and specks, which are more pronounced laterally. Prolegs marked with orange. True legs blackish ringed with paler. Some larvae are without the dark dorsal blotches, which are replaced by a zig-zag subdorsal line.

Pupa in a cocoon of brown silk mixed with larval hairs and spun in a leaf. Colour purplish brown. Thorax thickly covered with short pale hair, parted centrally and directed sideways. The abdominal somites ringed with dark rufous hair. Head, wing, leg and antenna cases smooth.

Food-plant—*Mimusops Elengi* Linn. (Sapotaceae). The larvae feed at night and rest gregariously on the trunk during the daytime.

Described from a full fed larva found in Calcutta 20-iv-38, pupated 1-v-38 and a male emerged 15-v-38.

There seems to have been some confusion over the situation of the scarlet transverse fold. Hampson places it on the 2nd somite and Moore between the 4th and 5th.

BOMBYCIDÆ.

Ocinara varians Wlk.

Moore, *Lep. Ceyl.*, ii, 136, pl. 133, fig. 1b. 1882-83.

Hamps., *Fauna Brit. Ind.*, Moths, i, 35. 1892.

Ova flattened discs. Yellow with a slightly varnished appearance. Laid in rows of eight to twelve. They become dark leaden grey the day before hatching. Hatch on the fourth day.

Young larva with the head greyish. Body with 2nd somite somewhat swollen. Dorsum whitish grey, a darker grey lateral stripe with a tooth projecting onto the dorsum on the 5th and 8th somites. A short fleshy grey horn on the 11th somite.

Full grown larva. Head brownish with a darker inverted V. Dorsum brownish, a dark greyish lateral stripe marked with orange brown on the 5th to 10th somites. Horn brown tipped with white, fleshy, not chitinised as in the Sphingidae. The larva is very variable, the dorsum may be any shade of yellow brown, grey brown or red brown, sometimes mottled and speckled with blackish, and the lateral stripe may be greyish or the same colour as the dorsum. Ventral surface greenish grey. Legs pale brown.

Pupa yellowish white, very slightly chitinised. In a boat-shaped cocoon of pale yellow silk, very closely woven and hard. Usually spun in a slight depression in a leaf.

Food-plant—Peepul (*Ficus religiosa* Linn.).

Described from a number of larvae bred from ova in Calcutta, one of which pupated 23-vi-38 and a male emerged 27-vi-38.

Both Moore and Hampson describe the horn as being on the anal somite.

SPHINGIDÆ.

Deilephila nerii L.

Moore, *Lep. Ceyl.*, ii, 14, pl. 82, fig. 1a. 1882-83.

Hamps., *Fauna Brit. Ind.*, Moths, i, 94. 1892.

Bell and Scott, *Fauna Brit. Ind.*, Moths, v, 268, pl. 3, figs. 10, 11. 1937.

Ovum—Usual Sphingid type but rather small for the size of the insect. Deposited night 23-vii-36. Hatched morning 30-vii-36.

1st instar—Head round, pale green. Body yellowish green. Horn black. Moulted 1-viii-36.

2nd instar—Head round, pale green. Body pale green, at first without markings but later two blue ringed white spots appear on the subdorsal part of the 3rd somite and a bluish lateral line dotted with white along the abdomen. Horn black, the base yellow. Moulted 3-viii-36.

3rd instar—Very similar to the previous one. The bluish lateral stripe edged above with yellow. A transverse line of white dots along the anterior edge of the 5th, 6th and 7th somites with the beginnings of a second line at the sides. 8th somite with similar spotting but the line broken on the dorsum. Moulted 5-viii-36.

4th instar—Similar to the preceding. The legs pink. The spots on the 3rd somite joined together into a kidney-shaped blotch only visible when the thoracic somites are extended. Spiracles black. Horn with the basal half stout and yellow green, the apical half very thin and hyaline, the two parts divided by a black ring. Moulted 7-viii-36.

Final instar—Similar to the preceding. Legs purplish. The spot on the 3rd somite with a dark indigo ring shading into the white centre. The lateral stripe almost obsolete on the 4th somite and the white lateral dots not present on the anterior part of the 4th, the posterior part of the 9th nor on the 10th somite. Horn yellow, very short and thick and curved downwards. Before pupation the ground colour changes; the head, the dorsal portion of the 1st somite and the area from the base of the horn to the 4th somite above the lateral line turning brown, this colour extending as a wedge along the dorsum of the 3rd somite. The rest of the body pinkish orange. Ceased feeding 10-viii-36. Pupated 12-viii-36.

Pupa—In a loose cocoon among litter on the surface of the soil. Pinkish tinged with orange, the abdominal somites sprinkled with black specks. Spiracles broadly ringed with black. A black median line on the thorax and ventrally from the head to the end of the wing cases. A male emerged 23-viii-36.

Food-plant—Oleander (*Nerium odorum* Soland).

Described from one of a number of larvae bred from ova in Calcutta.

Hampson describes the larva as 'Green, with a bluish lateral band from 4th somite to horn, with white oval spots on it, and others above and below it; 3rd somite with a blue ocellus; horn yellow.'

(*To be continued*).

NOTES ON SOME INDIAN BIRDS.

BY

E. H. N. LOWTHER, M.B.O.U., F.Z.S.

(*With* 6 *plates*).

III.—BIRDS IN MY GARDEN.

(*Continued from page* 560 *of Volume* xxxix).

By 'my garden' I mean the gardens of the different bungalows I have occupied during a service of over a quarter of a century spent with the East Indian Railway, in the exigencies of which I have from time to time been posted in different parts of Bengal, Bihar and the United Provinces.

Looking through my notes I find myself confronted with such an *embarras de richesse* that I hardly know where to start. I see that I have come across the nests of forty-five different species in the gardens of bungalows in which I have lived. Twenty-two of the number were found in one garden alone, in the Agra district. Over and above this, I have discovered the nests of nine additional species in my friends' gardens, including that of a Grey Hornbill, which found a nesting tree in Hume's old compound at Etawah.

SUNBIRDS.

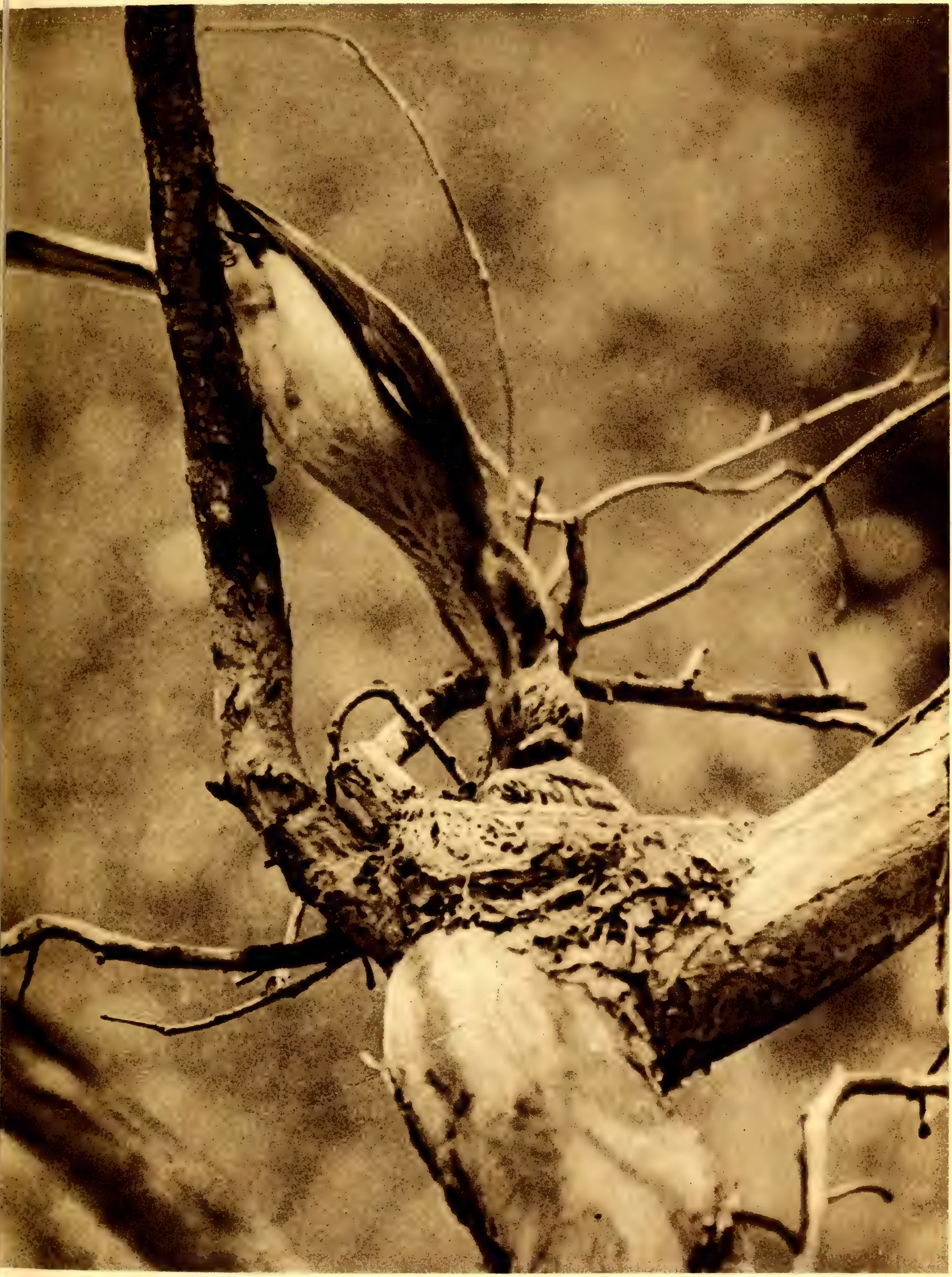
Much has been written lately concerning the manner in which the Purple Sunbird builds its nest—I ought perhaps to have said *her* nest because the male takes no part in this task. Nevertheless what I have observed may not be without interest. On 5 April 1922, while seated in a 'long-sleever' enjoying my *palan que char,* I noticed a female Sunbird flying from one bush to another, obviously prospecting for a nesting site. The choice eventually fell upon a slender twig of a small lime tree. As soon as this important question had been decided, the little bird busied herself with fetching materials for the home that was to hold her eggs. She had not far to go. Cobwebs, small pieces of bark or decayed wood, carpenters' shavings, bits of torn-up paper, cotton, cocoons, miscellaneous rubbish—are they not all to be found somewhere in every compound? However, even allowing for the fact that the materials were close at hand, I was surprised, the following morning, when I timed her in her building operations. Forty visits in forty and a half minutes, and fifty in sixty and a half minutes! Consider what this means—searching for the material, flying with it to the nest, incorporating it in the structure and then flying away to bring more, and it will be realised she allowed herself no respite. At 8-15, the Sunbird showed signs of feeling the effects of her labours and the visits to the nest then slowed down appreciably. Possibly this was due to a shortage of materials; more probably it was because of the heat; at all events, from mid-day till 2-30 she did not go near the nest. I imagine, like every other sensible person, up-country, she felt she needed a rest in the afternoon. Nevertheless, when I returned from office that evening, the pendent home was roughly fashioned, even down to the entrance hole. This nest held the first egg on 11 April, so that only six days were spent in its construction. Altogether three eggs were laid—a somewhat unusual clutch, two being the normal number. The eggs are a dirty-white in ground colour, with greyish-brown spots. A peculiarity about this species is that it frequently rears two broods in the same nest. I have a note also of it laying three lots of eggs in a nest I had under observation in my garden at Allahabad. Each clutch was destroyed, possibly by a Crow-Pheasant or blood-sucker lizard, though the nest was not damaged in any way until the third clutch was ravished.

Only once did I see the husband of the busy female, whose industry I have just related,—at least I presume he was her lawfully wedded spouse—go anywhere near the nest while it was being built. He perched on a neighbouring lime tree, rattled off a few canary-like notes, gave his wife the 'once over' and then, when she flew off to fetch more materials, pursued another of the opposite sex ! Not only does the male Purple Sunbird not assist in building the nest but I have never seen him incubate. When, however, the eggs have hatched, he takes a more active interest in family affairs and is to be seen frequently feeding the young although even in this respect he is never so assiduous as the female.

WOOD-SHRIKES.

I have never been able to understand how it was that Hume succeeded only once in finding the nest of the Common Indian Wood-Shrike. In those parts of the United Provinces with which I am familiar, which were its happy huting grounds too, it is a common species, frequenting *mango* and *seesum* groves as well as orchards and gardens. Perhaps it is because of its dull grey plumage that the bird so commonly escapes notice; nevertheless its note is a peculiar whistle which never fails to attract attention. The nest, if searched for in the ordinary way, is difficult to locate, though the reverse is the case if, in March and April, the birds are patiently watched. Like the White-browed Fantail Flycatcher and the Small Minivet, they are indefatigable workers, and during these months it is a simple matter with a good pair of field-glasses to watch either sex carrying materials to the nest under construction. Moreover the species is intolerant of the presence of other birds or small animals too close to its home. It was due to this little failing that I found my first Wood-Shrike's nest, built high up in a *seesum* tree. Since then I have on several occasions found the nest of this species in my garden, usually wedged into the horizontal fork of a *nim* tree, only, however, in the western districts of the United Provinces.

I know of no prettier sight than a Wood-Shrike building its nest. Both sexes engage in the task, and frequently, while one



A COMMON WOOD SHRIKE FEEDING ITS YOUNG.

bird is at the nest the other arrives with more material. The latter will not, however, 'do anything about it' until the first arrival has taken its departure. About the third or fourth day, the future nursery assumes something approaching its final shape. Then it is that the Wood-Shrike is frequently seen *in* the nest, applying cobwebs to the exterior, smoothing things down with its beak, which is used like a trowel, first working to the right and then to the left, and finally giving strength to the whole structure by pressing the sides inwards with its chin, all the while turning round and round in the nest. Ordinarily, three eggs are laid. Out of about 40 nests that I have examined, only once have I known this number exceeded, and then the nest contained a newly-hatched chick and three eggs. In the case of a nest built in my garden, incubation lasted fourteen days from the laying of the last egg. Both sexes take part in this task and sit closely. When the eggs are hatching, Wood-Shrikes seem to have no thought for matters mundane; their whole attention is concentrated on the little bodies that are coming into the world. On such an occasion, I once photographed at close range, and without using the hiding tent, a pair of these birds at their nest. So extraordinarily confiding was the female that, incredible though it may sound, she not only twice allowed me to lift her off her nest and put her back again, but even permitted me to place a finger between her open mandibles. While all this took place the male remained perched on the nest-bough only a few inches beyond the nest.

NUTHATCHES.

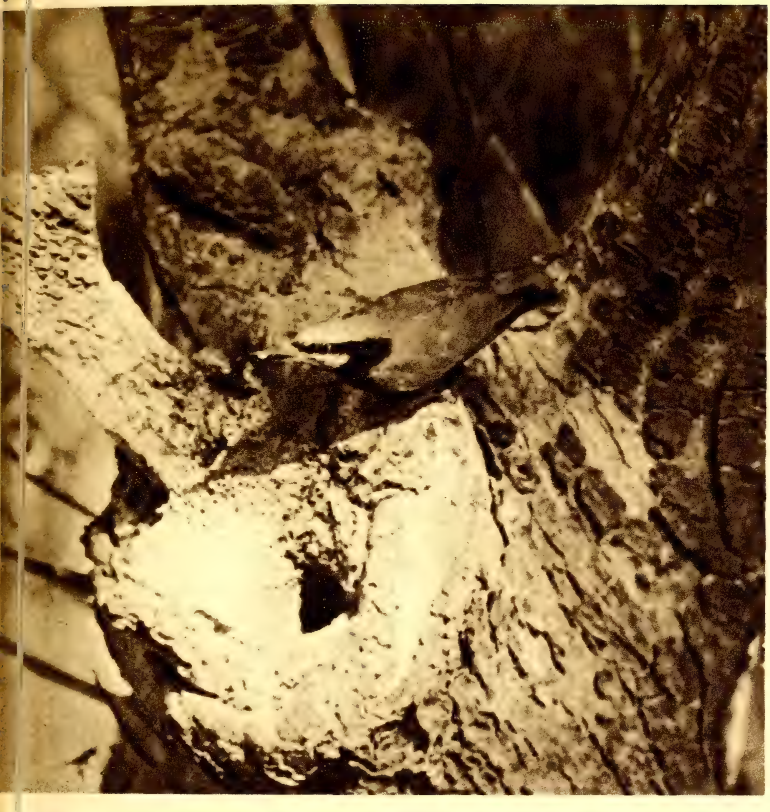
The Chestnut-bellied Nuthatch is a common visitor to those gardens where old *mango* and *siris* trees occur, and the sight of the bird, as it runs up or down or even sideways along the trunk of some gnarled giant, almost invariably leads the novice to believe he has spotted a really uncommon species. With the Tree Creeper he is usually familiar, but the slaty-blue upper plumage of the Nuthatch is to him an unknown quantity and therefore the bird is at once put down as 'rare'. Although it is so generally distributed, I confess to having found a Nuthatch's nest only once in a friend's garden and to having seen but three nests of *Sitta c. castanea* during twenty-seven years. I attribute my failure to the fact that the bird is a very early nester—nesting operations commence in February or the beginning of March at the latest—and my attention at this time of the year is usually directed to the different birds of prey. The nest may be low down, or high up, in a tree. A natural hole serves for the nursery but the hole is plastered up with mud and clay till the entrance is only about 1¼ inches in diameter—just large enough to admit the owners. The ease with which a Nuthatch enters and leaves the nest-hole is amazing. To me the bird always appears to be unusually broad-shouldered but it literally 'packs' itself up, and lo! we have *multum in parvo*!

The 30th of March 1938 opened in a most disappointing manner for me. I had gone to Etawah hoping to photograph a Common Quail on its nest. On arrival there, I found that my *zamindar* friend had been wrong in his identification. The bird whose nest he had found was the Jungle Bush-Quail, which I had previously photographed, and with the cutting of the *arhar* crop (in which the nest was situated) the eggs had been deserted. It was while breakfasting in my saloon, musing over my bad luck that I noticed a Chestnut-bellied Nuthatch working a *nim* tree and even descending to the ground in search of food. When the bird flew away and shortly returned, my curiosity was really roused. Following the Nuthatch on its departure again, with the glasses, I quickly found the nest-hole, which unfortunately, though quite invisible from the ground, was high up in a *nim* and overlooked the local gaol. However, thanks to the influence of friends, the municipal authorities allowed a *machan* to be erected in the road and on 7th April I was able to photograph the Nuthatch at home. The male is by far the handsomer of the two, and in addition was much bolder in facing the camera—in fact it did not worry him at all, even though not concealed in any way, a remark which also applies to myself, seated comfortably just behind the tripod. In spite, however, of being so fearless of camera and man, the obtaining of a successful photograph of the Nuthatch is no easy matter owing to its very rapid movements. Its industry is such as to give one the impression that the bird has awakened an hour late and is now doing its utmost to make up the time lost.

When first I found it, a pair of Common Mynahs paid repeated visits to the Chestnut-bellied Nuthatch's nest, frequently dropping a *nim* leaf into the hole, and on 7th April, when I was on the *machan,* the nest was from time to time visited by a Yellow-throated Sparrow, whose portrait I also secured. Such visits by other species to nests in holes of trees are not uncommon; the visitors often subsequently take possession of the hole for their own nesting purposes.

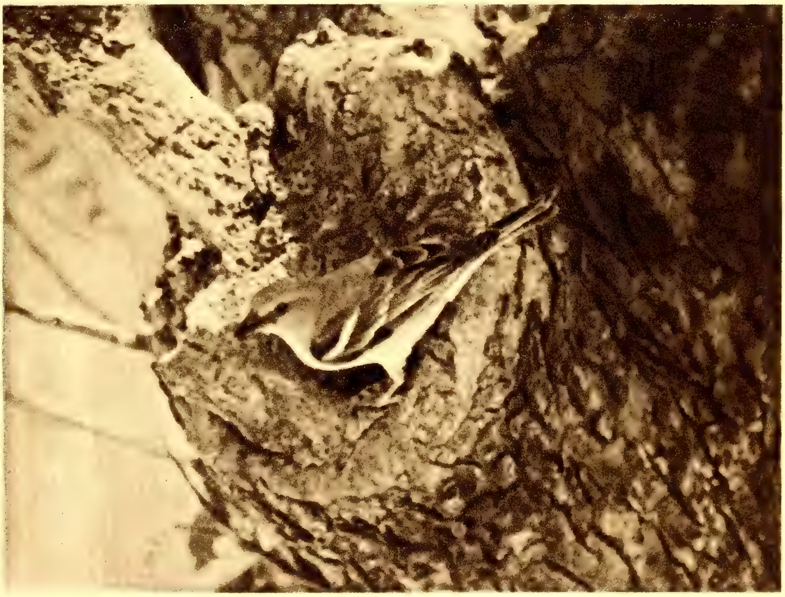
MYNAHS.

Three species of Mynah have honoured me by nesting in my garden, two of them, the Common and Pied Mynahs, frequently, and the third, the Brahminy Mynah, occasionally. In Northern India the last named nests only in holes in trees. The Common Mynah nests as often in a hole in a tree as in one in a building. More than once, however, I have come across a nest resting on the top of a pillar in the verandah. The nest of the Pied Mynah is constructed quite differently. It is a large, domed, irregular mass of long straws, roots, rags and twigs placed in the outer branches of some tree,—pieces of straw and grass frequently hanging down in the most untidy manner. Sometimes, several such nests may be found in the same tree. The interior is heavily lined with feathers, but the entrance to the egg cavity is by no means easy to find. Both Common and Pied Mynahs' nests seem to be particularly susceptible to raids by snakes. I well remember watching a cobra try to climb a *simal* tree in a hole of which a pair of Common Mynahs had a nest containing young ones. I think the snake would have succeeded in attaining its object had not the parent birds, and others of their kind, flung themselves repeatedly at the cobra as it tried again and again to negotiate



THE CHESTNUT-BELLIED NUTHATCH.

A natural hole in a tree served for her nursery. The bird plasters the entrance with mud and clay leaving a narrow opening.



The Nuthatch's nest was visited from time to time by a Yellow-throated Sparrow.

the *simal's* ample girth. On another occasion, my lunch was interrupted by the chattering calls of innumerable Pied and Common Mynahs; a number of House Crows were also making use of unpleasant language: again it was a cobra; but this time it had disposed of two baby Pied Mynahs, and as it rested by the nest, it was in turn disposed of by me.

I am reminded of three incidents as I write of the Brahminy Mynah. The first two relate to a time when I was photographing this species at the same nest. The nest in question was built in a hole of a *seesum* tree growing on the bank of a canal close to the railway line. Running parallel with and immediately adjacent to the track was a path much used by the local residents. A goods train passed, and as it did so, I noticed the second fireman take a large piece of coal and throw it deliberately at a woman who was walking along the path with an infant in her arms, missing her narrowly. Even now, twenty years later, my blood boils as I think of the dastardly act and of the approving smiles this beast won as he turned to his mates on the footplate. Fortunately I had seen everything clearly and noted the time, so that in due course the Locomotive Superintendent was able to deal faithfully with the entire engine crew who, it is almost unnecessary to add, resolutely denied the charge brought against them.

The other incident relating to the nest mentioned in the preceding paragraph was as amusing as the last was disgusting. I was not using a hiding tent, but had positioned the camera near the nest and decided I would conceal myself behind a bush and operate the shutter with a piece of string attached to it. I therefore passed the string through a hole bored in a stake placed immediately under the shutter, and led it along to the spot from where I was going to pull it when the occasion arose. The top of the stake was only two inches above the ground and, while not in use, the string lay loose. A squirrel noticed this string and thinking it would make her nest cosy started collecting it in its mouth, invariably pulling the loose end in until I gave this a jerk and frightened it away. On one occasion, however, she reversed the usual order of things before I realised what was happening and so released the shutter, thereby obtaining what I imagine must be the first photograph taken by an animal of a bird's nesting site.

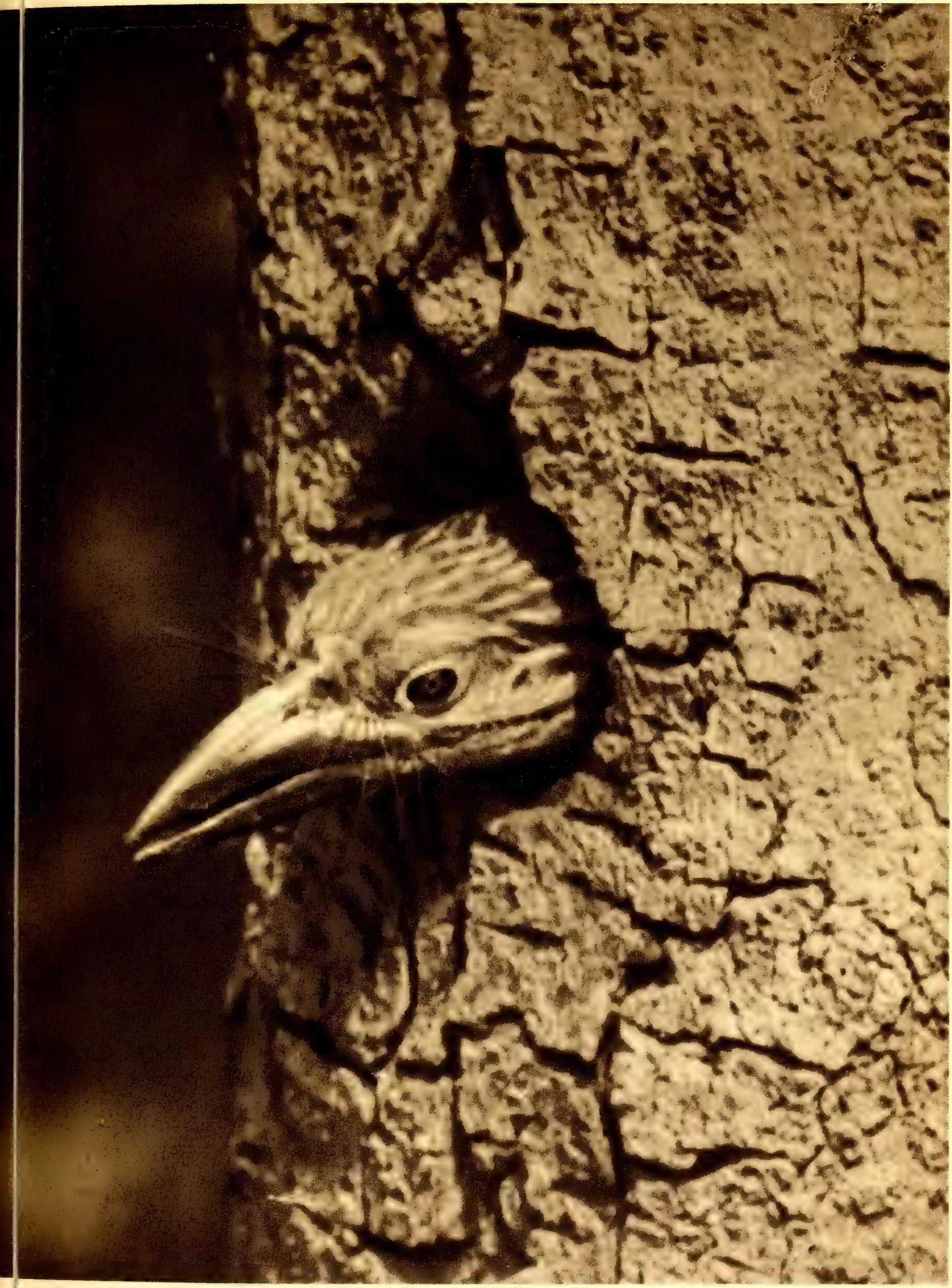
The third incident led me to think seriously of how young birds first leave their nests when these are built in holes in trees, etc. At the back of my mind existed an impression that the parents *drove them from the nest.* Where I got this idea from I cannot think. At the particular nest I am thinking of, the young were well feathered and it was clearly a question of hours only before they made their first public appearance. I had not long to wait. After I had photographed one of the adults at the nest neither parent would venture to feed the young again; instead, they remained on the branch of an opposite *nim* tree, with food in their beaks, uttering different notes and obviously cajoling the young to make the initial flight. When this had continued for half an hour or more, one young one, more venturesome than the rest—possibly it was the eldest too—appeared at the entrance of the hole and then popped back into the nest. After repeating this performance three or four times, it eventually decided to take the plunge and succeeded in reaching its parents although not without effort and not without anxiety on the latter's part, as was clear from the manner in which by their excited calls they encouraged the bold spirit to do its utmost. The young bird was then given double rations and was subsequently led away to a more leafy part of the tree with a view probably to escaping the notice of such enemies as the Shikra. I have since come to the conclusion that birds that lay their eggs in holes of trees regularly resort to such an expedient when the time has come for the young to leave the home. I have watched the same thing happen with a Northern Grey Hornbill and Crested Black Tits.

BARBETS AND WOODPECKERS.

Barbets and Woodpeckers are closely related; it will, therefore, not be inopportune to class them together for our present purpose. In many parts of the United Provinces one may confidently expect to come across the nests of the Green Barbet and the smaller Crimson-breasted Barbet in the same garden especially if *mango, gold mohur*, or cork trees are to be found therein. The prevailing colour in both species is green. The Crimson-breasted Barbet has some yellow, red and black about the head, near the eyes, about the chin and breast, yet so closely do these birds assimilate with the foliage of the trees in which they spend their lives that it is most difficult to see them, even though, from the *direction* of the calls, one obtains a fairly good idea of their whereabouts. I say *fairly good* advisedly, because their notes are somewhat ventriloquial in character owing to the manner in which these birds turn from side to side when calling. Their notes are amongst the best known bird sounds in India. '*Tonk-tonk-tonk*', says the Crimson-breasted Barbet, while the Green Barbet cries '*Kurr-r-r-r*, '*kooturuck-kooturuck-kooturuck*', till one is tired of hearing their notes.

As one would expect from their close relationship to the Woodpeckers, Barbets cut out a hole in a tree, either in the trunk, or more usually in one of the branches, wherein to deposit their eggs, the Crimson-breasted Barbet or Coppersmith frequently on the under-side of a more or less horizontal bough. Like woodpeckers' eggs, those of barbets are pure white in colour, but are very fragile and easily damaged, if one attempts to cut out a hole to obtain them. Barbets live principally on different fruits and are specially partial to the small berries of the *pipal* tree. They vary the diet somewhat when feeding the young. I have observed both species take the white- and black-winged flying ants into the nest-hole; and although one would never suspect the Green Barbet of being particularly active I have watched one catch a small dragon fly.

Very little has, I think, been recorded of the manner in which such birds as barbets and woodpeckers retire for the night. A pair of Coppersmiths I had under observation for some time in Cawnpore interested me greatly. Both parents fed the young until it was almost too dark to see, and then one of the birds always



A GREEN BARBET LOOKS OUT FROM ITS NEST HOLE.

retired to the nest-hole, while the other found shelter for the night in a neighbouring tree, in an old digging. Although I have not watched a Green Barbet retire for the night, it would seem that this species follows a somewhat similar procedure. I have noticed one come out of a hole before feeding operations could possibly have commenced for the day.

The only woodpecker, which I am *certain* had gone to rest for the night, clung to the under surface of a branch standing about 40° out of the horizontal. I watched this particular bird—a Golden-backed Woodpecker—take up this position on a *nim* tree just as it was growing dark, and it was still in this position when I investigated matters again shortly before 11 p.m. Another Golden-backed Woodpecker, which I *thought* had retired for the night, rested on the perpendicular surface of a palm tree. The bird remained in this position for about fifteen minutes, and it was then almost impossible to see, but something alarmed it and away it flew.

Two or three writers have stated that the food which woodpeckers take to their young is not visible in their beaks. This is contrary to my experience. I have photographed three different species of woodpeckers in India, the Kashmir Pied Woodpecker, the Mahratta Pied Woodpecker—at two nests—and the Black-backed Woodpecker, and in each instance the food for the young was often plainly visible as the parents arrived at the tree. Several of my photographs show this, though few are worthy of publication as owing to their rapid, jerky movements the genus has almost invariably defeated the shutter for speed.

KITES.

As a child I bore the Common Kite bitter hatred. I still have vivid recollections of how more than once, while seated out in the open in the early morning, breakfasting on buttered toast, one of these birds bore down on me from behind and snatched from my fingers the morsel I was on the point of eating. Occasionally I received scratches sufficient to draw blood; then it was that I retired, worsted, to receive poor consolation when I arrived indoors, my parents telling me I deserved all that had come my way. That, however, was more than forty years ago. Today I do not object to the Kite taking up its abode on my premises, the small chickens that it carries off being not mine but the cook's property. Often has that worthy asked me to shoot the *shaitans,* but I decline to interfere as it always gives me pleasure to see the birds about. Besides, if I did shoot the Kites, the price I would be charged for the chickens would be no less than I am asked today, so *cui bono?*

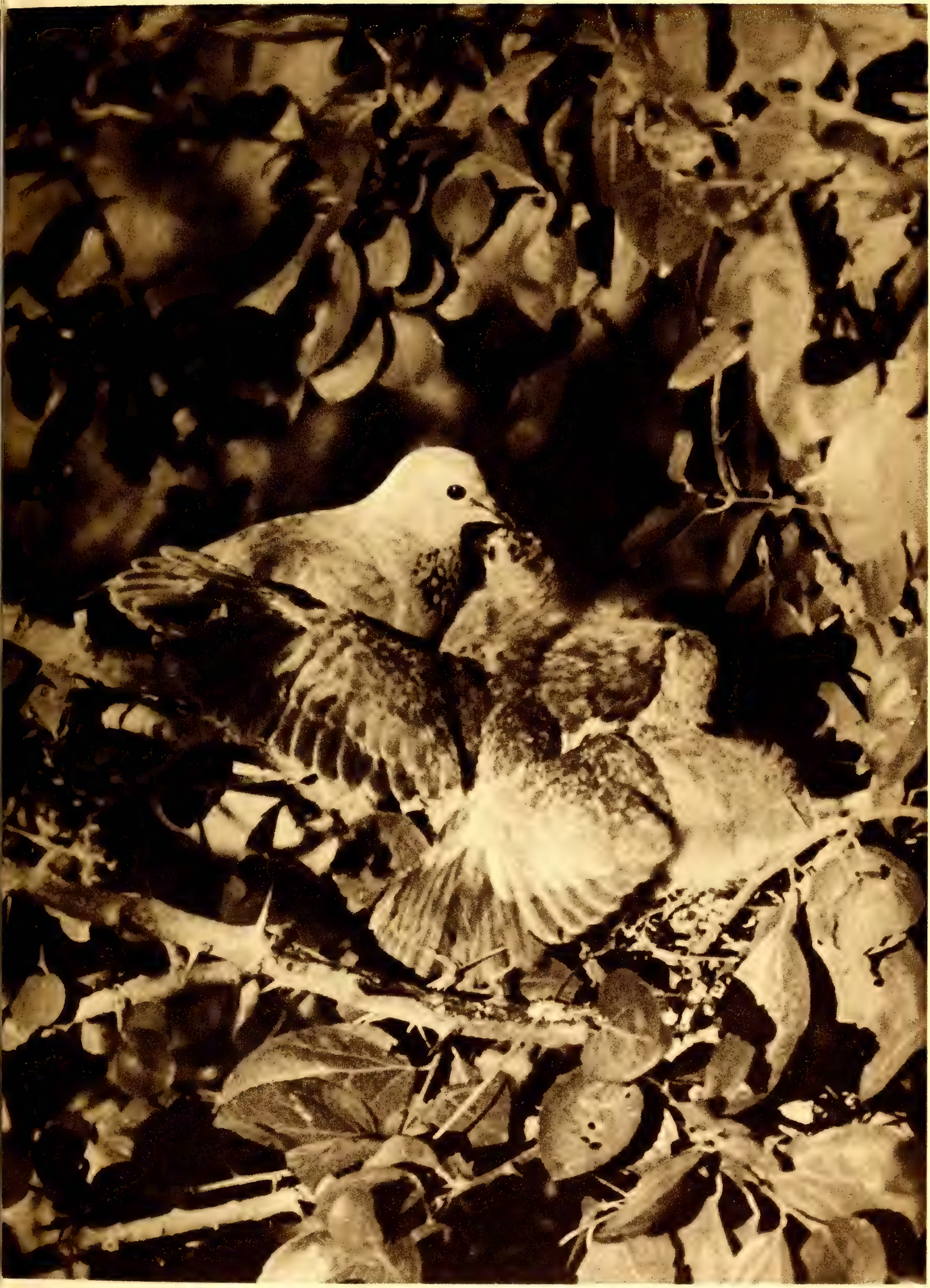
Like every other onlooker, I cannot help smiling when I see a Kite swoop down on some vendor's tray at a railway station, or snatch from some fat hand the tasty-looking sweets, freshly purchased, which are being conveyed back to a compartment in the open palm held on a level with the shoulders, that all may know how well-to-do is the purchaser. Which indicates (I am told) that I have a distorted sense of humour, while I argue—'from him that hath it shall be taken away.'

Almost invariably the Kite builds its nest near Man's habitation. It has a foundation of substantial twigs placed in the fork of some tree; wool, dirty old rags, cotton waste and similar material being used as a lining. I have seen stones and pieces of *kanker* worked in between the twigs and once came across a child's bow and arrow incorporated in a nest. On another occasion the three eggs in a nest in my compound rested on a hare's skin which the cook had carelessly thrown out near the kitchen. Usually two eggs are laid although three are not uncommon. These are greyish white in ground colour, sparingly blotched with brown and red. The long-drawn-out call of the Kite, *chee-eel,* from which the bird derives its common Indian name, is one of the familiar if unpleasant sounds of bazaar or cantonment.

Doves.

It seems strange at first sight that the behaviour of the same species should vary greatly in different parts of the country. Throughout the United Provinces, and elsewhere as well, I have found the Little Brown Dove and the Indian Ring Dove very tame, so much so that I neglected to photograph them when the opportunities were legion. In the Manbhum district in Bihar, however, both species are extremely shy. There is a good reason for this, everybody, both young and old, being bent on their destruction. Many a time in this and the neighbouring districts have I come across the most ingeniously constructed snares at the nest, added to which numbers are killed by means of bows and arrows. Elsewhere both species nest in gardens—the Little Brown Dove either in some bush, or on some ledge in the verandah itself. On one occasion I came across a nest of this species containing the usual two eggs at the foot of a bush, on the ground, on a high railway embankment. I do not remember having seen a Ring Dove's nest within the precincts of a bungalow. The bird instead builds its sketchy home regularly in some bush. I have found the nest of only one other species of dove in a garden: this belonged to a pair of Spotted Doves and was built on a verandah ledge.

The Little Brown Dove, whose photograph is shown herewith, had its nest in a thick prickly bush on a hill side covered with scrub-jungle. The nest was situated about three feet from the ground and, when I first attempted photography, contained two young ones about ten days old. The *hide* had been in position for two days and, although the parent birds were reported to be accustomed to it, hours passed before they returned to the platform of twigs. In the meanwhile much of interest was taking place at the nest itself and *in* the *hide,* to keep me occupied and even amused. At first both young ones indulged in a great deal of 'shut-eye'; after half an hour the younger squab preened itself, following this up by stretching first one wing and then the other. The elder youngster followed suit and finally both indulged themselves in this manner at the same time. They—especially the elder—also shifted their positions now and again. It was after I had been in the *hide* about an hour that a good deal of rustling began to take place amongst the dead leaves outside the tent. Thoughts of a snake or scorpion



THE LITTLE BROWN DOVE

Both young indulged in much wing flapping, one trying to oust the other to be fed first.

flashed through my mind, and great was my relief when a tiny muskshrew appeared on the scene instead and commenced to turn over the leaves between my legs, quite unconscious of the presence of Man. Two or three times I moved purposely, to frighten the little creature, when it disappeared at once only to re-appear soon afterwards.

When I had been in the *hide* about an hour and a half, both doves flew towards the nest, but settled on separate bushes a little below me. After some minutes the male flew away, followed a few minutes later by the female. After an hour both returned but again flew away, this time together, having in the meanwhile gone all round the tent. Shortly, the male returned to settle on a boulder, calling *croo* sharply, and later *cru-coo-coo-coo*. This brought the female and eventually both parents went to the nest together; the squabs in the meanwhile were most excited. The photo taken of the female at this session feeding the larger young one was spoilt by movement. Thereafter a gale sprang up shaking the hiding tent in an alarming manner so that I was not surprised when one of the parents alighted on a bush behind me and would not visit the nest.

The second photograph I took some two hours later was also not a success. I therefore moved the *hide* back a couple of feet, changed the direction slightly and leaving everything in position, with a man to keep watch, tried my luck again two days later, on 3 December. The young had grown greatly during the forty-eight hours and now appeared to be almost ready to leave the nest.

On this occasion again, I succeeded in taking only two photographs, both of which, however, were successful as the shutter was working at a higher speed. The small shrew, which during my first vigil had alarmed and then afforded me such amusement, now frightened the Little Brown Dove considerably as, out of sight, it rummaged about amongst the leaves at the foot of the bush holding the nest. When re-assured as to the author of the rustling noises, the male uttered his usual call but in a low key. Thereafter the note employed was a *ker-r,* this being used three times and approaching very near to a hiss.

Feeding the young is a most vigorous proceeding, the parent pushing its head down into the favoured squab's beak and then retreating, only to repeat the performance with its other child, both young indulging in much wing-flapping, one trying to oust the other with a view to being fed first, last and all the time. Photography under such conditions, with the principal actors in the drama in the heart of a bush, is by no means easy.

By way of contrast to the difficulties experienced in photographing the Little Brown Dove at home in a district where the genus is much persecuted, let me tell briefly of my only camera experiences with the Ring Dove, in the Sholapur district in the Bombay Presidency. There the cultivator and herd boy leave the birds alone so that all I had to do was to stick up the camera near a nest, cut away some offending twigs and proceed to take all the photos I could without even using the hiding tent. While I stood from four to five feet distant from the nest the incubating bird actually fell asleep but awakened at once if the shadow of a kite or crow passed over. On one occasion another Ring Dove cooed in the middle distance whereupon my particular bird stood up, and then bowing with the break right down in the nest, called in return.

House Crows.

No chapter dealing with garden-nesting birds would be complete without reference to the House Crow because, as soon as the monsoon breaks in Northern India, every tree in every compound seems to have one or more pairs nesting on it. It is remarkable how very few people are aware that this species is victimized in its nesting arrangements by the Koel, a member of the Cuckoo family. Although the Koel's egg is not unlike the Crow's in general colouring, the former is noticeably the smaller. In spite of this, and inspite also of *Corvus splendens* being the wariest and cutest of birds, no difference does it notice between its own eggs and those of the Koel. I say *those* not without good reason, because I once found a House Crow incubating one of its own eggs along with *three* laid by a Koel, and at another time found a Crow's nest containing three young Koels and one young Crow. I have seen it asserted, more than once, that the young Koel, like the young Cuckoo at Home and the Pied Crested Cuckoo out here, throws out the rightful progeny or eggs from the nest. Such, however, has not been my experience. I would not go so far as to state that this does not sometimes happen, but the fact remains, that I have again and again seen young Koels and baby House Crows grow up together.

As every resident in India well knows, the House Crow knows 'who's who and what's what'. Let me illustrate this. The experience I tell of deals with one of the earliest and most vivid recollections of my childhood. I had visited a House Crow's nest and purloined one of the young it contained. The parent birds had flown round and at me, saying terrible things while I was at the nest; but having reached the ground I imagined all was now well. Alas! As I made my way to the house, bare-footed and bare-headed, I was attacked in the most insolent manner from behind. First a terrifying peck on the head and, as I ran up the verandah steps frightened out of my life, an even more vicious one above the left heel, the wound inflicted still giving trouble some months later when I was in England. Not satisfied with the way in which they had already harassed me, that particular pair of crows saw to it that I did not venture out into the compound—at least I was not able to go out alone; which was very hard lines really. It was the height of the mango season, and as the succulent fruit fell to the ground it had been my wont to rush out and recover it, a form of amusement I was no longer in a position to pursue, my brother and our host's two daughters having to do the needful instead, the crows making no attempt to demonstrate against or attack them.

I recall a derelict young House Crow which had either fallen out of the nest by accident or had attempted a premature flight. My attention to it was drawn by the terrific noise that apparently all the crows in Hindustan were making at the back of the house. As I perched the youngster on a fencing stake, commotion became even more rife till I was reduced to wondering what I would have done in a similar predicament; it seemed clear that some were telling *junior* what he ought to do and others what he should not do so that in exasperation he seemed to cry out 'what *am* I to do?'

CROW PHEASANTS.

Mention of the Koel reminds me of the Crow-Pheasant, another member of the Cuckoo family which is seen commonly in the garden and not infrequently elects to nest therein—either in a thick clump of bamboos, a dense creeper or on some pollarded tree. The nest is a large, globular, domed structure of twigs with the entrance at one side and the egg cavity lined with green leaves. The internal dimensions must sometimes be insufficient to permit of the owners turning round, as I have occasionally noticed the bird incubating with the tail sticking out. This fact probably accounts for the species being so loth to leave the nest. Usually three eggs are laid, pure white in colour. The Crow-Pheasant is black, shot with green and dark blue, and has chestnut coloured wings. It trails a long tail which, as it struts along the ground, gives the novice the impression that he is gazing on a pheasant of sorts. The call is a deep, booming *whoop-whoop-whoop,* pleasant to listen to, and sometimes mistaken for the cry of the black-faced langur monkey. This is by no means the only member of the Cuckoo family found in India which builds its own nest, other not uncommon representatives being the Sirkeer and (locally) the two Malkohas. Of these I shall have more to say elsewhere. The Crow-Pheasant feeds on caterpillars, grasshoppers, small lizards *et hoc genus omne,* and is also, I fear, given to ravishing the contents of the nests of the smaller birds which make their homes in bushes and creepers. A bird I photographed had its nest, which was made of rushes only, in a clump of rushes. It will be long years before I forget the tortures I suffered from the massed attacks of a particularly objectionable variety of ant, half black, half red, as I sat inside the tent on a layer of rushes, waiting for the Crow-Pheasant to return to its nest.

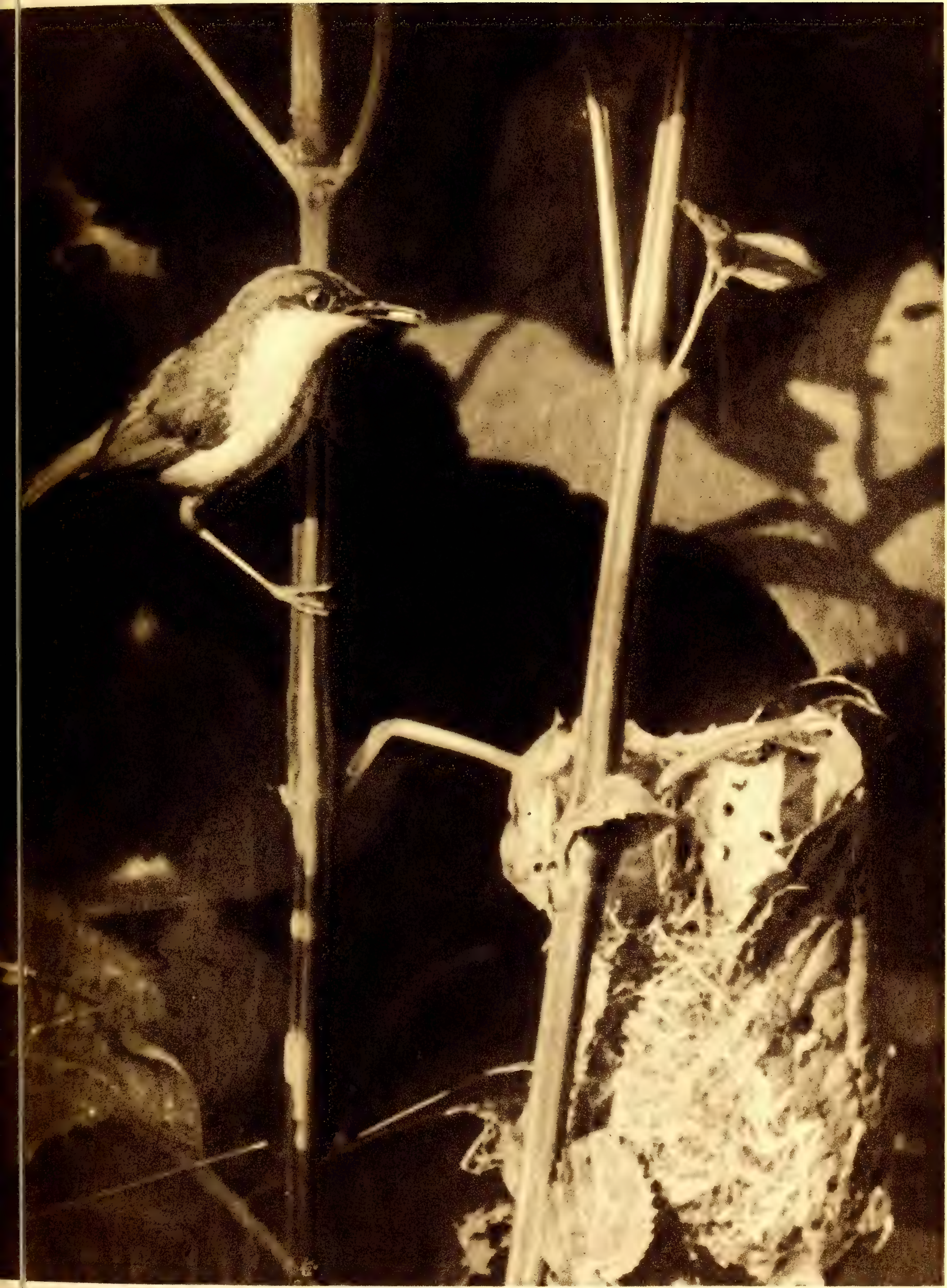
BULBULS.

The Red-vented Bulbul is to be met with everywhere; the same, however, cannot be said of the Red-whiskered species, a far more showy bird. It is extraordinary how capricious the latter is in its choice of habitat. Though common in both Cawnpore and Lucknow, commoner perhaps even than the Red-vented species, it is not to be seen in or around Allahabad, near Agra or many other districts of the United Provinces. Talking of the Red-whiskered Bulbul reminds me of when I was showing Major R. S. P. Bates, the well known contributor to the pages of the Bombay Natural History Society's *Journal* and author of *Bird Life in India*, round the Topchanchi reservoir in the Manbhum district. On his enquiring of me whether this species occurred in those parts I had to reply in the negative. However, I spoke too soon, for less than five minutes later we saw three or four in different places! They were to be met with commonly during the next two months, but I never saw the species again in the district during the winters of 1934-35 and 1935-36, neither did I come across the Red-whiskered Bulbul in the Manbhum district nor elsewhere in the Chota Nagpur division during the hot weather or monsoon months. Both are cheerful and vivacious souls, with calls which are very similar, and are popular bazaar pets. They feed, I think, entirely on caterpillars and fruit, and seldom settle on the ground. I once took a photograph of a Red-whiskered Bulbul under somewhat unnatural conditions. The bird in question had its nest in an *Antigonon* creeper; here a successful portrait was out of the question. I therefore removed the three young ones which the nest contained and placed them in a cage on my lawn with a twig hard by, on which I hoped the parents would alight. This they very obligingly did.

WARBLERS.

This is the correct place to write of two representatives of the family *Sylviidae*, the Tailor Bird and the Ashy-Wren-Warbler. Both are about five inches in length; both are 'loud squeakers' and both build their nests by stitching leaves together. In this respect the Ashy-Wren-Warbler is really the more skilled architect, as it can also build two other types of nest. Although so familiar by name it is remarkable how few people knew the Tailor Bird by sight. Above it is buff-green-brown in colour and below a dirty white. The forehead is rufous, the tail long and tapered and carried a great deal over the back, and the legs reddish. The Ashy-Wren-Warbler on the other hand is ashy-blue above with reddish-brown wings and the under parts a yellowy-buff, and the tail is what is termed cross-rayed. Both species have long and somewhat curved beaks; both call until one wonders when they are going to stop to take breath, the Tailor Bird shouting *towee-towee-towee,* and the Ashy-Wren-Warbler *jimmy-jimmy-jimmy,* rather faster than the former.

The Tailor Bird may construct its nest by puncturing a number of holes on either edge of a single large leaf, as for example, a *dhak* sapling or a *canna* plant, and make the two sides meet below by stitching them together; or may enclose the nest in a number of leaves sewn together. Usually the nest is situated only two or three feet from the ground, but I have found it about fifteen feet up in a *mango* tree and knew of another in a *guava* tree. Normally, four eggs are laid, pinky-white in ground colour, with red or reddish-brown spots and speckles, mostly round the broad end. Very occasionally, the ground-colour is bluish-green. A pair which built their nest in my garden at Allahabad during three consecutive years laid such coloured eggs each season, sufficient indication, I think, that the Tailor Bird is either a very stationary resident, or returns regularly to a favourite spot for nesting purposes. I incline to the former theory, as a pair were to be seen every day throughout the year in the precincts of the compound.



THE ASHY WREN-WARBLER,
a skilled architect, builds three types of nests

There is one matter I must not forget; I know of no species, with the possible exceptions of the Jungle Wren-Warbler and Crimson-breasted Barbet, which deserts its nest more readily than does the Tailor Bird. One has not even to touch the nest: it will quite likely forsake it if it thinks this has been seen.

The other two types of nest which the Ashy-Wren-Warbler constructs are a substantial oval-domed affair with the entrance on one side, the type most commonly found prior to the rains breaking, and 'a rudely built and flimsy ball of grass, supported by grass and weeds, sometimes fairly well attached to the supports, sometimes hardly fastened to them at all', a departure from the normal which I have never come across personally.[1] Uusually four eggs are laid, rather globular in shape and a rich bick-red in colour.

THE MAGPIE ROBIN AND SOME OTHERS.

The Magpie-Robin is a great lover of shade and for that reason is often a regular resident in large compounds well stocked with old trees. As everyone probably knows, the male when in full song is a really beautiful songster, being at his best in the early morning and again in the evening. How miserable though does his piping squeak sound in January, when first he begins to practise his notes! Most nests are built in holes in trees although I have occasionally come across one in a hole in a wall or building. It is my belief that only the female constructs the nest or incubates the eggs. This was certainly the case with a pair which had their nest in my garden and it was amusing to watch the manner in which the male pursued his wife with a view to driving her back to the nest if she left this for more than a minute or so.[2] Five eggs are usually laid, of a greenish ground colour with brownish-red spots and blotches scattered liberally all over the surface.

I remember finding a nest of this species on 15 June one year and removing one of the eggs for a friend who had started collecting. Carelessly leaving this on the ink-stand in my office with a view to blowing it one evening, judge of my surprise when on my return to lunch on the 22nd I found it had hatched!

Other beautiful and not unusual garden-nesting species are the Blue Jay, Hoopoe, Golden Oriole and the diminutive White Eye. The first two lay their eggs in a hole of either a tree or building, while the Oriole and White Eye construct hammock-like nests suspended between two horizontal twigs. In the case of the White Eye the nest is often attached to the stems of two adjoining leaves. Up country, the Hoopoe is familiar to everybody owing both to its note, *ook-ook-ook,* repeated quickly, and because of the way in which the bird works every lawn thoroughly in the search for ants. Not many may, however, have noticed that the Hoopoe is seldom, if ever, accompanied by more than one young one; which is surprising as it commonly lays seven or eight eggs. The inference is that mortality among the young birds is heavy although what this is attributable to is not so apparent.

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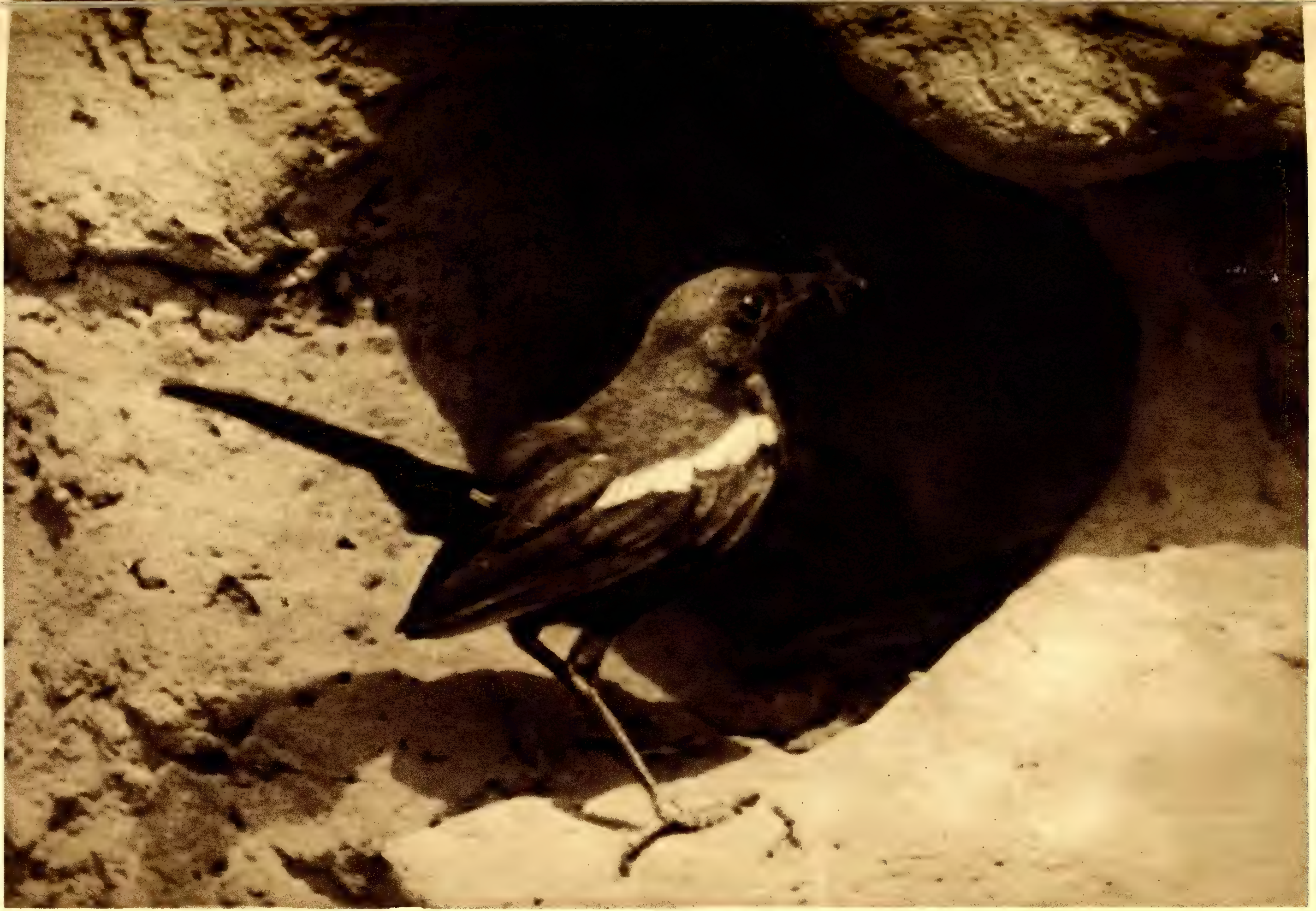
[1] *The New Fauna*, vol. ii, p. 530.

[2] The same was observed to be the case at Asansol in 1937.

It is a matter for congratulation that two such lovely birds as the Golden Oriole and the Blue Jay (in flight) should be so common. If only the latter could also be congratulated on its call! Alas! the Blue Jay croaks harshly and screams gratingly. Much can, however, be forgiven it for the wonderful aerial acrobatics which the bird performs as soon as the weather begins to warm up and its thoughts turn lightly to love making. Fortunately the Golden Oriole utters a liquid whistle, *pee-ooh,* rich in melody. It is surprising how few people know that the female of this species is differently coloured from the male, there being much green in her plumage.

The White Eye deserves a paragraph to itself. About four inches in length, the upper plumage is greenish-yellow; the chin, throat and vent are a bright yellow and the remainder of the lower plumage a light ashy shade. Round the eye is a conspicuous white ring. In the breeding season, which lasts right through the hot weather and extends well into the rains, the winter family parties break up. Then it is that the male sings his beautiful little song, so low that the average mortal does not hear it even though this soon becomes louder. As befits so tiny a species, the nest is small. Normally only two eggs are laid, I have found three, and as many as four have been reported. These are a pale greenish-blue in colour without any markings. Because of its size, necessitating the camera being very close indeed to the nest, the White Eye is a most difficult species to photograph successfully. What it lacks in inches the bird makes up for in pluck. I have known a pair not only hold their own with a pair of Little Minivets, but so out-manœuvre them that, disgusted by the manner in which they were harassed, the latter deserted the nest they were building so that the White Eyes were saved much trouble in searching for materials for the home which they also were constructing.

I have omitted all mention of such a common species as the Brown-backed Robin. Here again the sexes are differently coloured. One would like to write of the strange places this bird sometimes chooses for a nesting site, and how not uncommonly a piece of snake's slough is incorporated in its nest; or of the King Crow with the conspicuously forked tail, that delights in chasing crows and kites; and of Jungle Babblers, more commonly known as the Seven Sisters but which an American acquaintance equally aptly termed 'Hop-along', from the manner in which this species progresses by hopping; or of how I once watched *six* different adult Jungle Babblers feed the three young ones in a nest. The truth is I feel that this article has assumed such lengths I must now deal only with the Rose-ringed or Green Parrakeet, the common 'parrot' of India. My compound at Tundla, in the Agra district, where I was stationed for three years, was notorious for miles around for the myriads of these birds, along with numbers of Common Mynahs, that used to flight there every evening to take up their night's lodging. They came from all points of the compass, either in twos or threes, or as frequently,



THE BROWN-BACKED ROBIN
is versatile in the choice of a nesting site.

by the dozen, high up, flying straight, like arrows shot from bows, uttering their harsh calls and never seeming to deviate in their course. Only when almost on top of the *nim*, or cork trees on which they intended to roost did they wheel prior to alighting. Often they did not consider even this necessary but dived down at break-neck speed, invariably coming to a safe anchorage in the branches, from which they promptly proceeded to strip the foliage, the while uttering incessant squeals and squeaks. How they escaped disaster as they settled thus will always remain a mystery to me. Only very occasionally did one come to grief, not by alighting awkwardly, but by striking the telephone wires. Even so they escaped unharmed as a rule, only the wires vibrating for some seconds as a result of the impact.

For an hour before it was too dark to see my compound seemed to be the *rendezvous* of all the Green Parrakeets in India. They assembled literally in thousands; nor do I exaggerate when I say that as darkness was stealing o'er the land it was impossible to tell at a range of only ten yards what tune a gramophone outside was playing, so overwhelming was the noise the parrots and mynahs made. Then, as the light failed, the birds would quieten down until the silence could almost be *heard*.

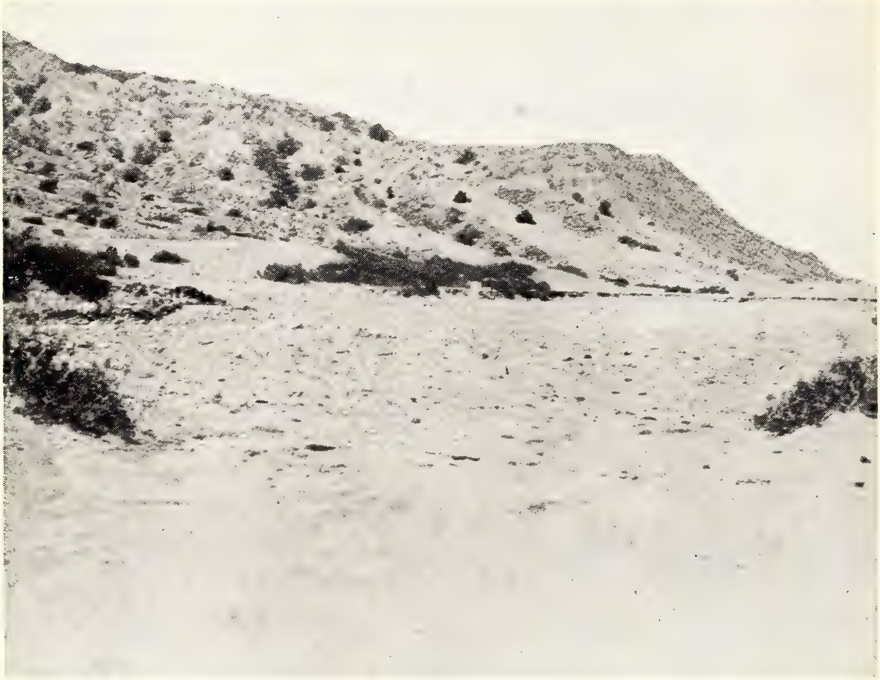
Evensong was over.

At intervals throughout the night there would be a regular fluttering, this beginning at one tree, going to the next, and so on in sequence right through the compound, very much like the *totem* scene in *Rose Marie*. Always this was followed by the patter of the birds droppings striking the ground below. I could never make out what caused the parrots to flutter in this manner. Sometimes it seemed that a human being passing by was the reason; at others a gentle breeze springing up appeared to have something to do with this 'shivering' movement.

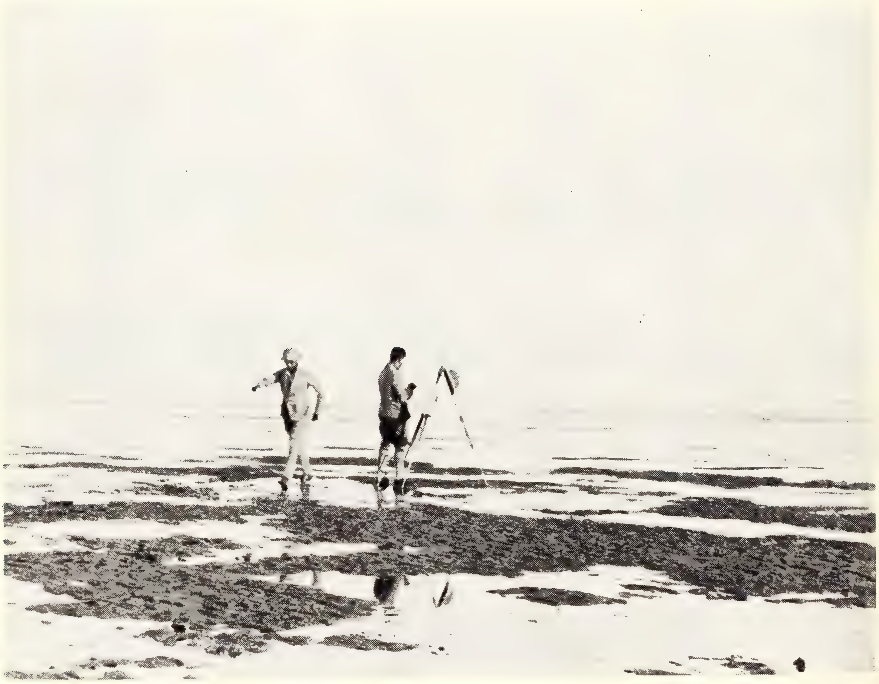
Ordinarily the parrots lot was a happy one, but at times life was made miserable for them. In the gathering dusk, when the trees were full of birds, a Laggar Falcon would dive straight in amongst them—never amongst the mynahs—and carry off a screaming victim. Sometimes the stoop was unsuccessful. When such was the case, the falcon, after circling round once or twice at no great distance, returned to the fray a second and even third time. Always it left finally with a parrot held firmly in both feet, protesting vigorously but to no purpose. Then pandemonium reigned supreme amongst the birds resting in the tree; in a body they would fly away shrieking, only to alight again in some other tree hard by, there to continue awhile their grotesque movements and the stripping of more foliage.

Wonderfully provided though a falcon is for capturing and killing its prey, it seems incredible that any small raptorial should attack, much less kill, such a formidably armed bird as the Green Parrakeet, possessed, as it is, of a beak that can inflict severe injury. Nevertheless, I witnessed such an assault on at least half a dozen occasions, and once, with the aid of the field-glasses, saw how the falcon carried off its victim : one foot seized the parrot above the neck, close to the head, and the other was fixed firmly into the middle of the back, so that the bird could use neither its beak nor claws. The Lugger was not the parrots only avian enemy. A pair of Rock-Horned Owls that lived in the ravines near by also took constant toll of them. One bright moonlight night I saw one of these fine birds make its way into a tree, from which the parrots at once flew helter-skelter, shrieking at the top of their voices. Presently the great owl re-appeared and settling on the tennis court within a few yards of where I was seated proceeded to tear to pieces, and then to eat, the parrot it had caught.

Poor parrots ! the *sahib* and the *ryot* have no love for you owing to the damage you do in the garden and to the crops in the fields. And yet, in spite of the awful noise you made every evening, and every morning long before it was dawn—except in your nesting season when you scarcely visited me; in spite too of the havoc you wrought amongst my fruit trees, I have a very tender spot in my heart for you and wish you a long and happy innings in the dear old compound. I was always delighted when towards the end of February or early in March I found you had appreciated my hospitality and that you and your wife had decided to bring up your family in a hole of one of my trees. Nowhere were your three or four white eggs, or your young, safer. Our sex has often been accused of paying too little attention to the nursery, but you were ever a model husband, taking turns with your Better Half in incubating the eggs, and later working like a slave to feed your young. Farewell, and Good Luck to you !



Low Hills on the border of the Great Rann at Nir Wand, Pachum Island, Cutch.



The condition of the Great Rann, 15 miles north of Nir Wand, in September 1935.

Photos by Author.

THE REPTILES AND AMPHIBIA OF CUTCH STATE.

BY

CHARLES McCANN, F.L.S.

(*With two plates*).

Cutch State is at certain times of the year isolated from the mainland. The periodical isolation takes place in the years of good rains, when the Great Rann and the Little Rann are flooded. During the dry season the Ranns are dry and perfectly hard, but quite uninhabitable as not a blade of grass is to be found in any part of them. The ground, in fact, is in many places covered with thick incrustations of salt. The fauna of the State is chiefly composed of desert and semi-desert species met with on the neighbouring mainland.

The records and specimens at my disposal indicate that little is known of the amphibian and reptilian faunas of Cutch State. This paper is an attempt at putting together such data as are available. The records are drawn from the collections of the Bombay Natural History Society, the *Fauna of British India* (Reptilia, 2nd Ed), and from specimens and observations made by the author during a three-weeks' tour to the Great Rann during the latter portion of September and the early part of October 1935. Most of the material in the Society's collection is from Mr. C. A. Crump, who surveyed the mammals of the State on behalf of the Society in 1912.

ORDER : LORICATA : Alligators and Crocodiles.

FAMILY : CROCODILIDÆ : Crocodiles.

Crocodilus palustris Lesson. The Mugger, Marsh Crocodile or Broad-snouted Crocodile.

This crocodile is found in some of the inland lakes. I have seen specimens in the artificial lake at Chawa. The Benas River enters the Eastern or Little Rann and, as crocodiles are fairly numerous in this river, their presence in the lakes is easily understood. They also occur in Kathiawar.

ORDER : TESTUDINES : Turtles, Tortoises and Terrapins.

FAMILY : CHELONIDÆ : Marine Turtles.

Caretta caretta. The Logger-head Turtle.

According to Captain V. C. Steer-Webster this species comes ashore at Mandvi to breed.

FAMILY : TRIONYCHIDÆ : Freshwater Turtles.

Lissemys punctata granosa (Schoepff.) Soft-shelled Turtle.

'The Bombay Presidency, including Cutch' (*F.B.I.*, 2nd Ed.).

ORDER : SQUAMATA : Lizards and Snakes.

SUB-ORDER : SAURIA : Lizards.

FAMILY : GECKONIDÆ : Geckoes.

Gymnodactylus kachhensis kachhensis Stoliczka.

'Common throughout Cutch, mostly in crevices of rocks, and very rarely seen in houses (Stoliczka).' *F.B.I.*

Hemidactylus flaviviridis Rüppel. Common House Gecko.

Locality : Bhuj (McC. !), common in houses in Cutch.

FAMILY : AGAMIDÆ.

Sitana ponticeriana Cuv.

The *F.B.I.*, 1st. Ed. mentions this species as occurring in Cutch but the 2nd Ed. does not.

Calotes versicolor (Daudin). The Bloodsucker.

This species is quite common throughout Cutch. I have seen them at Nir Wand, Pachum Island, on the very edge of the Great Rann.

Uromastrix hardwickii Gray. The Spiny-tailed Lizard.

Common in many parts of Cutch, Kawra, Pachum Islands (McC. !).

Note.—A few of these lizards were dug out of their burrows and one was swamped out by filling the burrow with water. The burrow goes down almost vertically for a foot or so and then down at an angle of about 45°. At the end of the burrow, which is about six to eight feet long, there is a chamber sufficiently large to allow the animal to turn round. The mouth of the chamber is usually closed by the spiny tail.

FAMILY : SCINCIDÆ.

Mabuya macularia (Blyth).

Locality : Cutch (*F.B.I.*, 1st. Ed.). In the second edition this species is omitted.

Ablepharus grayanus (Stoliczka).

Locality : Cutch (*F.B.I.*, 2nd Ed.).

Eumeces tænioiatus (Blyth).

Locality : Cutch (*F.B.I.*, 2nd Ed.).

Ophiomorus tridactylus (Blyth).

Locality : Cutch (*F.B.I.*, 2nd Ed.).

FAMILY : LACERTIDÆ.

Acanthodactylus cantoris cantoris Gunther.

Locality : Bhuj (B.N.H.S. collection !).

Ophiops jerdoni Blyth.

Locality : Cutch (*F.B.I.*, 2nd. Ed.).

Ophiops microlepis Blanford.

Locality : Cutch (*F.B.I.*, 2nd Ed.).

FAMILY : VARANIDÆ.

Varanus monitor (Linn.). The Common Monitor.

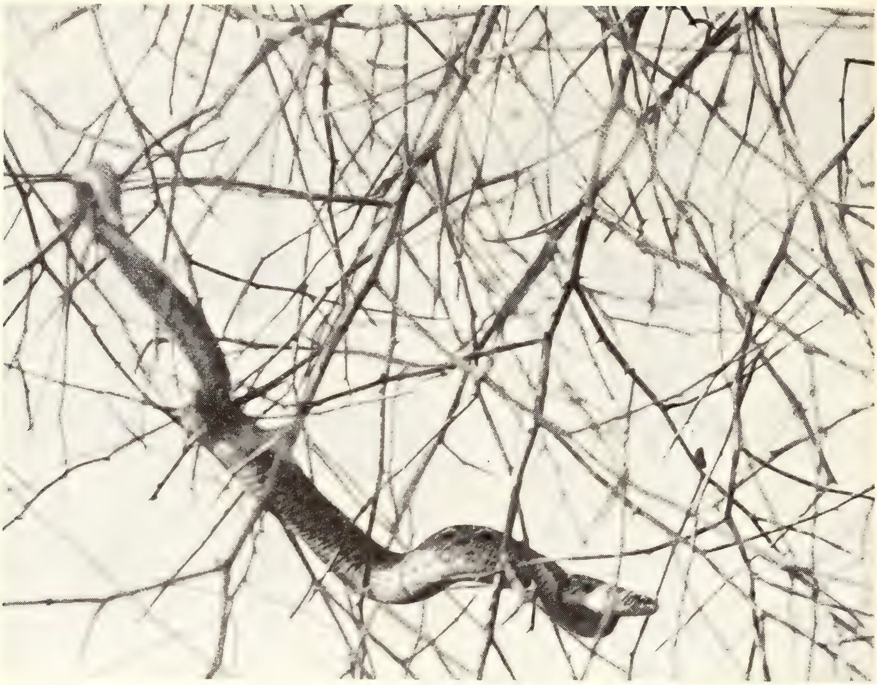
Locality : Bhuj, among old tombs (McC. !).

SUB-ORDER : OPHIDIA : Snakes.

FAMILY : BOIDÆ.

Eryx johnii (Russ.). Sand Boa.

Locality : Cutch (*F.B.I.*, 1st Ed.) ; Nir Wand to Kakra (McC. !).



The Saw-scaled Viper or ' Phoorsa ' [*Echis carinata* (Schneider)] basking in a bush of *Capparis aphylla* Roth in the Bunny, Cutch.

Leith's Sand Snake (*Psamophis leithii* Gunth), at Nir Wand, Pachum Island.

Photos by Author.

Family : Colubridæ.

Lycodon striatus Günth.
Locality : Bluj (Crump. Nov. 1912 !).

Zamenis ventrimaculatus Gunther.
Locality : Cutch (*F.B.I.*, 1st Ed.).

Zamenis diadema Günth. The Royal Rat Snake.
Locality : Nir Wand, Pachum Island (McC. !).

Coluber helena Daud. The Trinket Snake.
Locality : Cutch (*F.B.I.*, 1st Ed.).

Dipsas trigonata Boie. The Brown Tree Snake.
Locality : Bhuj (S. D. Smith, 28-10-13 !).

Psammophis leithii Günth.
Locality : Cutch (*F.B.I.*, 1st Ed.) ; Nir Wand, Pachum Island (McC. !).

Note.—A very active snake frequently lying in wait among branches for its prey even during the hottest time of the day.

Psammophis condanarus Blyth.
Locality : Cutch (*F.B.I.*, 1st Ed.).

Bungarus cæruleus Daud. The Common Krait.
Locality : Bhuj (Crump, 2 specimens 1912 !).

Naia tripudians Merr. The Cobra.
Locality : Bhuj (Crump, 4 specimens 1913 !). Both the black and the pale variety occur.

Hydrophis spiralis Gray.
Locality : Cutch Coast (*F.B.I.*, 1st Ed.).

Family : Viperidæ.

Echis carinata Merr. The Saw-scaled Viper.
Locality : Cutch (*F.B.I.*, 1st Ed.) ; Nir Wand, Pachum Island (McC.) ; The Bunny (McC. !).

Note.—A large specimen taken in the Bunny was amid the branches of *Capparis aphylla* quite four feet from the ground. This is the first instance I know of this species climbing trees (see photo). This snake is very common in Cutch.

ORDER : BATRACHIA.

Family : Ranidæ.

Rana cyanophlyctis Schneid.
Locality : Bhuj, in tanks (McC. !).

Rana tigrina Daud.
Locality : Bhuj, Farm Bagh (McC. !).

Family : Bufonidæ.

Bufo andersonii Bouleng.
Locality : Bhuj (McC. !) ; Kawra, Pachum Island (McC. !) ; Nir Wand, Pachum Island (McC. !).

Note.—This toad came out at night in fair numbers at Nir Wand and most of them would collect in a small patch of freshwater where they would sit for a considerable time. During the day they retreated into old rat holes.

THE FOOD OF BROWN TROUT (*SALMO FARIO* L.).

BY

DR. HAMID KHAN, Ph.D. (Cantab.),

Fisheries Research Officer, Punjab, Lyallpur.

(*With a plate*).

It is almost thirty years ago when brown trout was first introduced into the streams of the Kulu Valley in the Punjab, and since then it has been the main attraction for visitors to the Valley. It has provided good sport and good food. Yet, strange as it may appear, no attention has so far been paid to the problems the solution of which is necessary for the proper foundation of trout fisheries. For example, no precise information is available concerning the food and the feeding habits of brown trout during the various months of the year. It is evident that this subject is of paramount importance not only to the anglers for the immediate purpose of discovering the fly upon which the fish would come, but more so to those charged with the care and maintenance of trout waters. There is a general cry that trout fishing is degenerating. Is it so? If the answer is in affirmative, then we have to ask why?

Again, trout—an exotic species—has been introduced into Himalayan waters with consequent reaction on indigenous fauna and disturbance of balance of nature. What has been the influence of this on the composition of trout food and the cycle of events in the streams?

According to Southern (1935), for any intelligent conservation and improvement of trout fisheries it is necessary to know for each river and lake the following:

1. the age and rate of growth of the stock;
2. the kind and amount of food consumed;
3. the kind and amount of food available;
4. the effects on the food supply and on the number and rate of growth of the trout under various environmental conditions;
5. the extent of the natural spawning facilities and their relation to normal stock;
6. the capacity of the river to nourish fry of trout and to bring them to maturity.

A proper study of these problems will mean years of hard intelligent research and it is undoubtedly essential. Of the problems set out above, the present paper is concerned with the kind and amount of food consumed by brown trout in the Beas River in the Kulu Valley in the Punjab, as studied by the examination of its stomach contents.

The study of the food of trout has received much attention in Europe, America, Australia and New Zealand. The diet of trout has been found to consist of 'shrimps, water snails, insects, worms, etc., and small fish such as minnows and young of their own species.' (Regan 1911, Mottram 1928, 1931, Rushton 1931). Pentelow, (1932) in England, Metzellar (1929) in Michigan, Phillips (1929) in New Zealand and McKeown (1934 a, b) in Australia, investigated the food and feeding habits of trout by the examination of stomach contents and classified the contents as land insects, water insects, fish, crustacea, molluscs and such trash as gravel, wood and other debris.

MATERIAL AND METHODS.

The material, consisting of 102 stomachs of brown trout, was obtained mostly from anglers during the fishing season which lasts from the 1st March to the 30th October. No data on the food during winter months are available yet. The maximum weight of the fish examined was 3 lbs. 4 oz., and the minimum 3 oz. The lengths of these fish, up to the tip of the caudal fin, measured 190 mm. to 500 mm. Most of the fish were caught on[1] wet fly, i.e. artificial fly submerged just below the surface of water and imitating the nymphal stages of May flies and caddis flies. Some fish were caught on grasshoppers and worms. The bait in such cases was weighted and thus hooked mostly the bottom feeders.

The stomach contents consisted almost entirely of animal matter. The food in the front limb of the *U*-shaped stomach was, in most cases, almost undigested and was, comparatively speaking, easier to identify than that in the hind limb where its digestion had advanced. In the intestine, identification of the semi-digested food was impracticable.

In a preliminary study as this, no attempt has been made to make specific identification. Surveys of most of the aquatic insects and their immature stages in the Kulu Valley have not yet been carried out, and in the absence of such knowledge it was difficult to refer the collected material to species. The insect contents have, therefore, been classified into larger groups.

Results have been tabulated to show the distribution of various types of food taken by the fish for each month of the season. Under 'Unidentified' Coleoptera, Diptera and Hymenoptera, are included parts of insects and their larvae, and under 'Miscellaneous Insects' are shown such larvae and insects as were in a semi-digested condition and as such unidentifiable.

I am grateful to those anglers who supplied the stomachs of their catches, and I also owe my thanks to the Sub-Inspector of

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[1] Fishing with a 'dry fly', i.e. by an artificial fly floating on the surface of water and imitating the winged insects, is only possible on slow running streams and has never been, and cannot be, practised on Himalayan streams.

Fisheries, Kulu, for assisting me in the collection work. I am grateful to my colleagues in the Entomological Section of the Punjab Agricultural College, Lyallpur, for the assistance which they gave in the identification of various insects.

RESULTS OF STOMACH EXAMINATION.

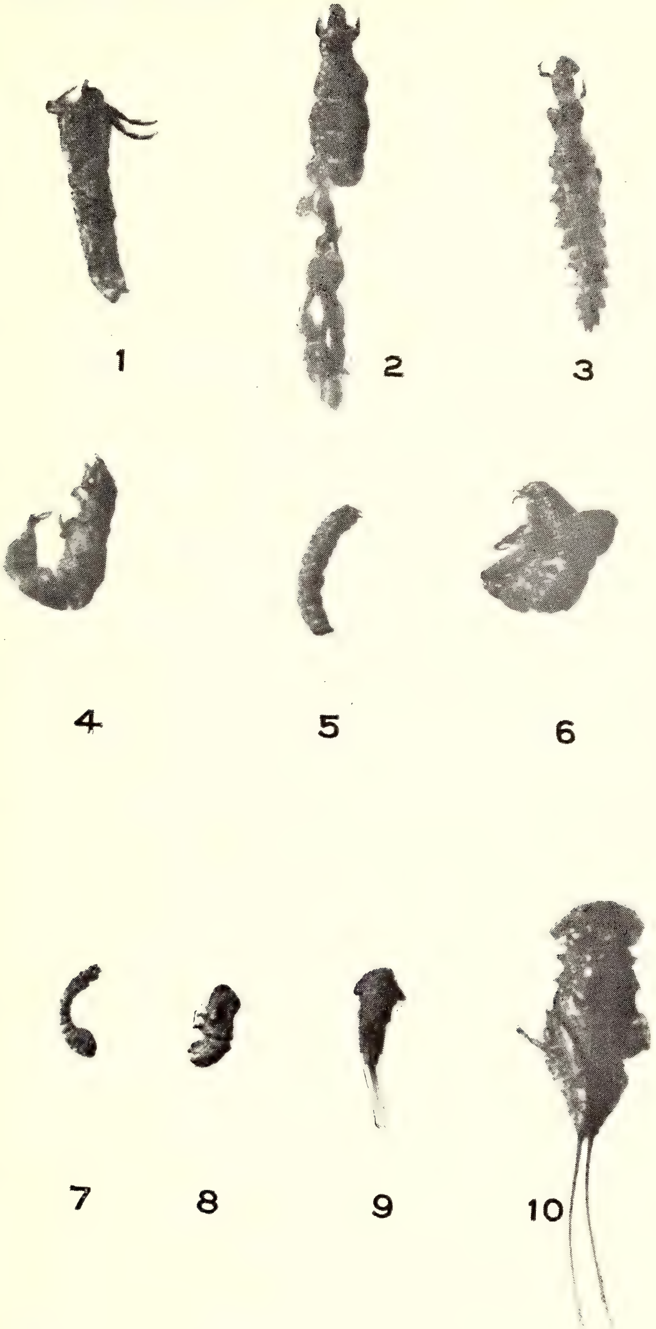
The trout is entirely carnivorous. The only indications of vegetable matter were small sticks found inside the stomachs in five cases. These had been swallowed along with caddis cases. In one specimen collected on the 20th May, 1937, 36 sticks were picked out. In two others, small grass seeds were found. No remains of water plants were found inside any stomach. The stomachs and intestines invariably contained sand and gravel-remnants of the caddis cases.

The contents of stomachs arranged in order of importance as food of trout, consisted of the following:—

(1) INSECTS: Caddis flies (Trichoptera), May flies (Ephemeroptera), Beetles (Coleoptera), True flies (Diptera), Ants and Wasps (Hymenoptera), Butterflies and Moths (Lepidoptera), Grasshoppers (Orthoptera), Dragon flies (Odonata), Earwigs (Dermaptera), Bugs (Hemiptera), Alder flies and Ant Lions (Neuroptera), and Stone flies (Plecoptera). (2) PISCES. (3) ARACHNIDA. (4) MYRIAPODA. (5) MOLLUSCA. (6) CRUSTACEA. (7) OLIGOCHAETA and (8) AMPHIBIA.

Adult caddis flies were not found, and the larvae (Fig. 1-6), belonged to Sub-families Sericostomatidae, Hydropsychidae and Rhyacophilidae. No adult May flies were recorded and the larvae found (Figs. 9-10) belonged to *Baetis, Ecdyurus, Ephemerella* and *Iron*. Of the Coleoptera, adult forms of both the terrestrial and aquatic beetles were present, the former represented by Chrysomelidae, Carabidae and Scarabaeidae, had in all likelihood fallen from overhanging trees, or had been washed down by the floods and swallowed by the fish. Larvae of Curculionidae were fairly well represented in the stomachs of fish caught during September and October. Of the aquatic forms one adult Gyrinid was the only representative. The Diptera included the larvae of Simuliidae and Blepharoceridae (Figs. 7, 8), Cyclorrhapha and Syrphidae. Hymenoptera consisted of adult ants (Formicidae), Bees (Apidae), and wasps (Vespidae and Scolidae). The Lepidoptera consisted of caterpillars which could not be specifically identified. The Orthoptera included grasshoppers, which in two stomachs, collected in June, formed natural constituents of trout's diet, and in other cases were used as bait. The Odonata consisted of three Dragon fly larvae, and the Dermaptera, of three Earwig nymphs. Of the Neuroptera, two larvae (Sialioidea) were found in one stomach. Of the Plecoptera, only one larva was present in one specimen.

Out of the thirteen fish (Pisces) found in thirteen stomachs, one was definitely trout fingerling. It was found in the stomach of a fish, weighing 11 oz., collected on the 6th August, and measured 90 mm. in length. It filled the whole of the stomach, which had no other organism in it. In three cases, the stomachs



Contents from the stomach of a trout caught on the 11th April, 1937.

(*Photograph from actual specimens*).

Figs. 1-6. Caddis larvae (Trichoptera).
Fig. 7. Simuliidae larva.
Fig. 8. Bleppharoceridae larva.
Figs. 9-10. May fly larvae (Ephemeroptera).

contained barbel fry (*Oreinus sinuatus*), and in the remaining eight stomachs the fish fry was unidentifiable on account of its semi-digested condition.

The Arachnida consisted of two spiders, and the Myriapoda of one immature and one adult Scolopendra.

The Mollusca included one slug; and Crustacea were represented by one terrestrial Isopod; the Earthworms (Oligochaeta) had been used as bait. The Amphibia consisted of one tadpole found in a stomach collected in June.

DISCUSSION.

Trout's diet: Practically any organism that is found in the water or on its surface is a possible food for the trout (Table I). The number of organisms found in a stomach varies according to the size of the organism swallowed. If the organisms are large in size, such as fish, frog or slug, their number is naturally small. But where small animals, such as caddis or May fly larvae are eaten, their number may be large. The largest number of caddis larvae taken from one specimen was 153 and there was nothing else inside the stomach. The stomach contents of a trout (Figs. 1-10), caught on the 11th April, 1937, consisted of 24 caddis larvae, 9 May fly larvae, one Blepharocerid larva, one Simuliium larva and two unidentifiable larvae. The various components of fish diet ennumerated above illustrate the variety and nature of trout's diet.

The influence of floods on the food of trout: In Tables II and III, stomach contents of fish, caught during the months of May and August, are given for comparing the food consumed by fish before and after the rains. In May, Trichoptera were found to the extent of about 60 per fish, while in August, the number had diminished to about 10. In May, one stomach out of 24, and in August 7 out of 14, contained fish fry. Out of 102 stomachs examined, 56 were collected after the rains, and out of these (Table IV), two in July, two in August, four in September and one in October, were found to be empty. That is to say, 16 per cent of the stomachs collected after the rains had practically no food in them. No empty stomach was found before the rains. Moreover the stomachs collected after the rains contained less food than those collected in the beginning of the season. The rains which commence in July, flood the river heavily and evidently cause great disturbance in the supply of available insect food.

Cannibalism: Out of 102 stomachs examined, only one case of cannibalism was recorded. It cannot, therefore, be said with any certainty that brown trout is cannibalistic in its habits. Mitchell (1914), working in Kashmir, also pointed out that in brown trout 'cannibalism is not natural and is only resorted to in special cases where other food is not available.' The question of cannibalism in trout requires thorough investigation, because if at any time food becomes scarce the life of little trout fry, with which the River Beas in the Kulu Valley is stocked annually, will be endangered.

Surface and submerged food: According to Pentelow (1932) a broad classification of the food can be made 'according to its origin, whether it is found on the surface of water or whether it is found in the water'. The former he calls 'surface' and the latter 'sub-surface' food. The greater part of the surface food, he remarks, 'consists of aquatic Diptera, Trichoptera, Ephemeroptera and Plecoptera. These insects after leaving the water have to return to it to lay their eggs and it is, therefore, natural they will make up the greater part of the surface food.' Sub-surface food is not defined by Pentelow (1932), but the term is meant to include all kinds of submerged food, whether free in the water or at the bottom of the stream.

Seasonal occurrence of surface and submerged food in the stomach of brown trout, (Table IV), indicates that the fish seem to feed on surface as well as submerged food during the whole of the season.

The abundance of submerged food and scarcity of adult flies in trout stomachs seem to show that the trout in the River Beas in the Kulu Valley is mostly a bottom feeder. For instance, while the larvae of caddis flies, commonly known to the anglers as *Grannom, Welshman's Button, Red Sedge, Cinnamon,* and of May flies called *March Brown, Olive Dun,* etc., form the principal constituents of trout food, adults of these insects are absent from stomach contents.[1]

Comparative study of trout's diet in various countries: A comparative statement of the average food per fish in the Kulu Valley, New Zealand (Phillips 1929) and New South Wales, Australia (McKeown 1934) is given in Table V. Comparison cannot be taken too far as the fish in the Kulu Valley, New Zealand and Australia live under entirely different environmental conditions, and the quantity of food varies not only according to the size of the fish but also according to the nature and density of the local fauna. Size of trout under study in the Kulu Valley varied from 3 oz. to 3 lbs. 3 oz. and of trout in Australia from 1 lb. to 4 lbs. Average weight of Kulu fish was, therefore, less than that of the Australian trout. Trout in the Kulu Valley, however, has practically the same variety of food as it has in other countries. A noticeable feature, however, is the negligible number of Crustacea and Mollusca in the stomachs of the Kulu trout.

It may be of interest to quote in this connection Mosely (1926), who commenting on Tillyard's Report (1921) on the effect of introduction of trout on the native insect fauna in New Zealand, adds that 'Nowadays trout are being introduced everywhere and perhaps we are deluded by the immediate success of our efforts. The history of New Zealand waters warns us that we must look beyond the immediate future and that stocking should be carried out on a very moderate scale, while sanctuaries for trout insect food should be established in all areas where trout is being introduced. Crustaceans and Molluscs should be imported if not already present, to offer an alternative diet to the fish. Otherwise, the trout may thrive lustily in the virgin waters, increase abundantly, and by reason of their well doing, doom themselves to inevitable destruction.'

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[1] On most parts of the River Beas it may, therefore, be said, that, as has also been pointed out by Howell (1914), 'the spoon and phantom and creeper will kill fish more readily than fly.'

The effect of introduction of trout on the native insect fauna of the Kulu Valley is not known. The present investigations, however, indicate that though there is no immediate danger to the depletion of aquatic fauna, yet the food of trout in the Kulu Valley requires immediate attention. The present investigations, it is believed, will give sufficient impetus to further research on the subject and steps will be taken to improve the food of trout by establishing sanctuaries for insects, as advised by Mosely (1926), in side streams where trout should not be allowed to penetrate and also efforts will be made to introduce some suitable Crustacea and Mollusca to offer an alternative diet to the fish.

SUMMARY.

1. The food of the brown trout (*Salmo fario* L.) living in the Beas River in the Kulu Valley in the Punjab has been investigated by the examination of stomach contents of 102 fish.

2. The food consists of aquatic and terrestrial insects and their larvae such as Caddis flies (*Trichoptera*), May flies (*Ephemeroptera*), Beetles (*Coleoptera*), True flies (*Diptera*), Ants, Bees and Wasps (*Hymenoptera*), Butterflies and Moths (*Lepidoptera*), Grasshoppers (*Orthoptera*), Bugs (*Hemiptera*), Alder flies and Ant Lions (*Neuroptera*) and Stone flies (*Plecoptera*). Besides insects, the trout feeds also on young fish (*Pisces*), Spiders (*Arachnida*), Scolopendra (*Myriapoda*), Snails and Slugs (*Mollusca*), Crustacea, Worms (*Oligochaeta*), Frogs and Tadpoles (*Amphibia*). Crustacea and Mollusca are present in negligible quantities in the stomachs, and the worms present were in all cases used as bait.

3. The stomachs collected after the rains contain smaller quantities of food than those collected early in the season. No empty stomach was found before the rains, but 16 per cent of the stomachs collected after the rains, were empty. The rains cause heavy floods and disturb the supply of available food in the river.

4. Disturbance in the supply of available food after the floods probably drives the trout to feed on fish fry.

5. The abundance of submerged food and scarcity of winged flies in the stomachs seem to indicate that the trout in the Beas River is mostly a bottom feeder.

6. The trout in its Indian habitats is consuming practically the same variety of food as in England, New Zealand, Australia and America.

TABLE I.

Monthly comparison of stomach contents of Brown Trout (*Salmo fario* L.) from the River Beas in the Kulu Valley.

	April 1937	May 1937	June 1937	July 1937	Aug. 1937	Sept. 1937	Oct. 1937	Total
Number of stomachs examined ...	13	24	9	11	14	27	4	102
TRICHOPTERA ...	397	1439	67	135	138	103	10	2289
EPHEMEROPTERA ...	43	38	2	2	7	30	4	126
COLEOPTERA								
Gyrinidæ ...	...	...	...	...	1	...	...	1
Curculionidæ ...	...	...	...	...	...	39	10	49
Chrysomelidæ ...	...	2	...	...	...	2	...	4
Carabidæ ...	1	2	1	...	...	2	...	6
Scarabæidæ ...	...	...	3	...	...	4	...	7
Unidentified ...	...	8	26	2	2	7	1	46
DIPTERA								
Blepharoceridæ ...	2	2	1	...	...	4	5	14
Simuliidæ ...	1	1	...	...	...	2	...	4
Cyclorrhapha ...	...	38	...	...	...	...	...	38
Syrphidæ ...	...	...	...	...	1	...	1	2
Unidentified ...	1	4	...	3	1	...	2	11
HYMENOPTERA								
Formicidæ ...	...	17	3	8	2	34	...	66
Apidæ ...	...	...	1	...	...	2	...	3
Vespidæ ...	...	...	...	...	...	1	...	1
Scoliidæ ...	...	1	...	...	...	...	...	1
Unidentified ...	...	1	...	1	...	1	...	3
LEPIDOPTERA ...	...	4	7	...	...	1	1	13
ORTHOPTERA								
Acridiidæ ...	...	1	10	1	1	4	...	17
Mantidæ ...	...	...	...	...	...	1	...	1
ODONATA ...	1	1	...	1	...	...	...	3
DERMAPTERA ...	...	3	...	...	...	...	...	3
HEMIPTERA								
Capsidæ ...	...	...	...	...	...	...	1	1
Jassidæ ...	...	1	...	...	...	...	...	1
NEUROPTERA								
Sialioidea ...	...	...	2	...	...	...	...	2
PLECOPTERA ...	...	1	...	...	...	...	...	1
MISCELLANEOUS INSECTS ...	5	19	8	1	4	2	...	39
PISCES ...	3	1	2	...	7	...	...	13
ARACHNIDA ...	1	...	...	...	1	...	...	2
MYRIAPODA ...	...	...	...	1	...	...	1	2
MOLLUSCA ...	...	...	...	1	...	...	...	1
CRUSTACEA								
Isopoda ...	...	...	...	1	...	...	...	1
OLIGOCHAETA ...	...	...	...	2	...	...	...	2
AMPHIBIA ...	...	...	1	...	...	...	...	1
MISCELLANEOUS								
Sand-gravel ...	o	o	...	...	o	...	...	
Twigs-seeds ...	o	o	...	...	o	o	...	

o Indicates presence.

TABLE II.

Summary of stomach contents of each Brown Trout (*Salmo fario* L.) caught from the River Beas in the Kulu Valley during the Month of May 1937.

Serial number of stomachs.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
Length in mm.	287	275	337	287	275	256	256	300	275	269	275	300	275	275	250	250	350	287	350	300	300	275	262	300	
Weight in oz.	10	9	16	10	8	7	6	10	8	7	9	11	10	10	7	7	14	10	17	11	10	9	8	10	
Sex	F	F	M	M	M	M	M	F	M	M	F	M	M	F	M	M	F	F	F	F	M	F	F	M	
TRICHOPTERA	125	3	24	42	83	82	119	42	107	12	12	2	127	49	26	23	17	4	78	153	101	106	49	53	1439
EPHEMEROPTERA	1	...	...	...	8	1	...	1	...	...	...	1	2	1	2	10	3	2	2	...	...	2	1	1	38
COLEOPTERA																									
Chrysomelidæ	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
Carabidæ	...	...	...	..	...	...	...	...	...	...	2	...	...	...	..	...	...	...	...	...	...	...	...	...	2
Unidentified	...	...	...	1	...	...	...	1	1	...	...	...	...	...	...	...	1	4	...	...	...	...	...	...	8
DIPTERA																									
Blepharoceridæ	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
Simuliidæ	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	1
Cyclorrhapha	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	36	...	38
Unidentified	...	...	...	...	...	...	...	3	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	4
HYMENOPTERA																									
Formicidæ	...	...	...	...	...	...	1	...	1	...	1	...	3	...	...	1	3	4	...	...	...	...	2	1	17
Scoliidæ	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Unidentified	...	...	...	..	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	1
LEPIDOPTERA	...	...	...	...	...	...	...	1	...	...	...	...	...	1	...	2	...	...	...	...	...	...	...	...	4
ORTHOPTERA																									
Acridiidæ	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	1
ODONATA	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	1
DERMAPTERA	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	...	...	...	...	...	...	...	...	...	3
HEMIPTERA																									
Jassidæ	...	...	...	...	...	...	...	...	...	...	..	...	...	...	1	...	...	...	...	...	...	...	...	...	1
PLECOPTERA	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	1
MISC. INSECTS	...	...	...	...	...	...	...	...	...	...	...	1	4	...	...	5	8	...	...	...	...	1	...	...	19
PISCES	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	1
MISCELLANEOUS																									
Sand-gravel	o	o	o	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...	o	o	o	o	o	o	
Twigs-seeds	...	...	...	...	...	...	...	...	...	...	...	...	o	...	...	...	...	...	...	...	o	o	o	o	
Digested remains	...	...	...	...	...	...	...	...	...	o	o	...	o	...	...	o	o	o	...	o	...	o	o	o	

F = Female. M = Male. o indicates presence.

TABLE III.

Summary of stomach contents of each Brown Trout (*Salmo fario* L.), caught from the River Beas in the Kulu Valley during the Month of August, 1937.

															Total
Serial number of stomachs ...	1	2	3	4	5	6	7	8	9	10	11	12	13	14	14
Length in mm. ...	325	312	287	300	225	325	250	250	300	312	300	250	325	362	
Weight in oz. ...	13	12½	11	11	5	12	8	8	10	14	12	6	16	20	
Sex ...	M	F	M	F	M	F	M	M	F	M	M	F	M	M	
TRICHOPTERA ...	..	...	...	...	...	28	87	5	18	...	...	...	...	...	138
EPHEMEROPTERA.	...	...	...	...	...	3	1	1	...	...	2	...	...	...	7
COLEOPTERA															
Gyrinidæ ...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	1
Unidentified ...	...	2	...	...	...	...	...	...	...	..	...	...	...	...	2
DIPTERA															
Cyclorrhapha ...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1
Syrphidæ ...	..	...	...	...	...	...	...	...	...	...	1	...	...	...	1
HYMENOPTERA															
Formicidæ ...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	2
ORTHOPTERA															
Acridiidæ ...	...	...	...	...	...	1	...	..	...	...	...	...	...	...	1
MISC. INSECTS ...	1	...	...	...	...	2	...	1	...	...	...	...	...	...	4
PISCES ...	1	1	1	1	...	1	...	...	...	...	...	...	1	1	7
ARACHNIDA ...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	1
MISCELLANEOUS.															
Sand-gravel ...	...	...	...	...	...	...	o	...	...	...	...	...	...	...	
Twigs-seeds ...	...	...	...	...	...	o	...	...	...	...	...	...	...	...	
Digested remains ...	..	...	...	...	...	...	o	o	...	...	...	...	...	...	

F = Female. M = Male. o indicates presence.

TABLE IV.

Seasonal occurrence of surface and submerged food in the stomachs of Brown Trout (*Salmo fario* L.) in the River Beas in the Kulu Valley.

	April	May	June	July	August	September	October	Total
Number of stomachs examined ...	13	24	9	11	14	27	4	102
Empty stomachs ...	...	...	...	2	2	4	1	9
Stomachs with surface food ...	...	...	...	...	...	9	...	9
Stomachs with mixed surface and submerged food ...	2	2	5	4	2	10	2	27
Stomachs with submerged food ...	11	22	4	5	10	4	1	57

TABLE V.

Study of the average per fish for each kind of food for trout (*Salmo fario* L.) in the Kulu Valley, New Zealand and Australia.

	Kulu (India) 1936-37	New Zealand 1927-28	1928-29	New South Wales and Australia 1933-34
Number of stomachs on which averages are based ...	102	48	42	27
TRICHOPTERA ...	22·40	129·72	163·02	29·70
EPHEMEROPTERA ...	1·23	13·77	19·88	·27
COLEOPTERA ...	1·09	1·12	·54	5·06
DIPTERA ...	·67	1·31	2·64	·90
HYMENOPTERA ...	·70	·08	·07	4·00
LEPIDOPTERA ...	·12	·02	...	·45
ORTHOPTERA ...	·176	·047	...	·85
ODONATA ...	·029	...	...	4·30
DERMAPTERA ...	·029	...	...	...
HEMIPTERA ...	·019	·33	·26	1·73
NEUROPTERA ...	·019	1·20	1·64	...
PLECOPTERA ...	·009	·43	·64	...
MISC. INSECTS ...	·38	...	...	...
PISCES ...	·127	...	...	...
ARACHNIDA ...	·019	·02	·16	·30
MYRIAPODA ...	·019	...	...	...
MOLLUSCA ...	·009	15·41	21·94	·72
CRUSTACEA ...	·009	·083	1·02	·42
OLIGOCHAETA ...	·019	·04	·35	...
AMPHIBIA ...	·009	...	...	...

The figures denote the averages of the various orders of animals eaten per fish.

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THE MIGRATION OF BUTTERFLIES IN INDIA.

BY

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(*With one coloured plate and 4 diagrams*).

INTRODUCTORY.

The migrations of birds and mammals have been known for many centuries, and similar movements of fishes are now being studied with results of great practical importance. Among the insects great swarms of locusts have always attracted attention, but the fact that extensive movements take place in other groups is still but little known to the general public, and even in some cases to the naturalist himself.

It is now however a well established fact that many species of butterflies and moths make regular movements in the adult stage, over distances which frequently exceed a thousand miles. Thus in North America, the Monarch Butterfly (*Danaus plexippus*) flies in great numbers each Autumn from Southern Canada to Florida, the Gulf States or Mexico, and then returns to repopulate the northern area in the Spring.

In Western Europe and North Africa the Painted Lady (*Vanessa cardui*) flies regularly in large numbers from the borders of the North African desert, across the Mediterranean, northwards through Europe, and may in extreme cases reach Iceland and almost to the Arctic Circle in Russia.

That the phenomenon is not a rare and unusual occurrence may be seen from the fact that of the sixty-eight species of butterflies known to occur in the British Isles, fourteen are partially or completely dependent on immigration from the Continent for their continued existence in Britain.

The known movements of the migrant butterflies have been slowly established by the collection of individual records of directional flights, and also by discovery (often very difficult to verify) that certain insects are only to be found over large areas at one particular time of the year.

MIGRATIONS IN INDIA.

In India the latter form of evidence is not generally available, owing to insufficient study, but it has been used in support of the supposed migrations of the moth *Agrotis ypsilon* from the 'tal' lands of Mokamek in Bihar.

Directional flights of butterflies have however been known to occur here for many years.

The first record that I have been able to trace is in an English newspaper *The Liverpool Mercury and Lancashire General*

Advertiser of just a hundred years ago. In the issue for 21st December 1838 there is a paragraph which states 'Mr. Moore records a flight in India of butterflies which extended 500 miles, and Mr. Barrie describes one in Africa which occupied an area of 2,000 miles'. In a later issue of the same newspaper (4th January 1839) the Editor comments that stories about locusts can apparently be believed, but he considers stories of great flights of butterflies as merely 'flights of fancy'!

Several records and discussions of butterfly flights in Ceylon appeared about the middle of last century, but interest in India did not seem to be aroused till about the end of the century, when several short papers and notes appeared in the *Journal* of the Bombay Natural History Society and elsewhere.

Since then observers of strikingly large flights have occasionally sent in their records for publication, but no one has made any continuous study of the subject except Mr. J. Evershed, F.R.S. who was for many years Director of the Observatory at Kodaikanal, in the Pulni Hills, South India at an altitude of about 7,700 feet. Mr. Evershed observed directional movements of butterflies at Kodaikanal on numerous occasions between 1907 and 1914, and also in 1921. In 1926 he kindly placed the whole of his notes at my disposal and a full report on them has already been published (Williams 1927). Summaries of his observations will be given below.

Directional flights of butterflies are also known to occur in most of the countries bordering on India. In Ceylon they are particularly frequent and the available evidence was summarised by the present writer in 1927.

In Burma and Malaya movements seem to have been less frequently observed, but they are not uncommon in Siam and the East Indies, and probably only need a close watch to be found almost everywhere.

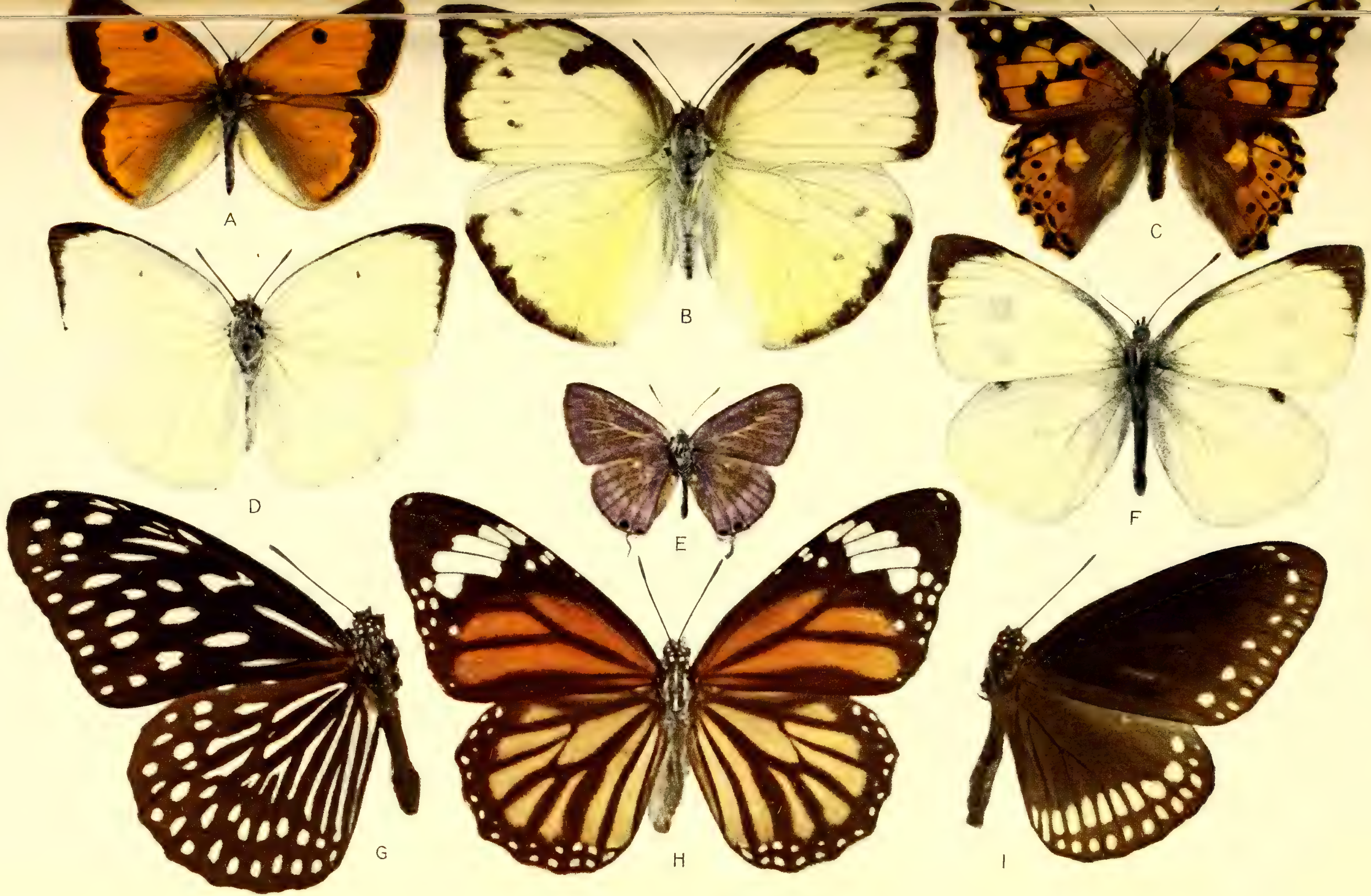
For the area to the North of India no information is forthcoming.

INFORMATION AT PRESENT AVAILABLE IN INDIA.

In 1930 (Williams 1930) I made a general survey of the problem of migration of butterflies throughout the world, and included in it notes on the Indian butterflies that had been known to migrate. It appeared from the evidence then available that the species concerned in the migrations in the foothills of the Himalayas were very different from those of Central and South India. In this present review therefore the records along the mountains in the north will be kept distinct from those of the rest of India.

In order to summarise as briefly as possible the records that I have so far traced, they are condensed into three tables. Table I shows the records for North India and the Himalayas; Table II Evershed's records for Kodaikanal; and Table III shows the records for the rest of the country. Finally Table IV gives a list of all the species which have been recorded as migrating anywhere in India with the names of the observers of their movements.

All the flights in Tables I-III are shown in diagrammatic form in Fig. 1.



John Bale, Sons & Curnow, L^td London.

INDIAN MIGRANT BUTTERFLIES.

A. *Colias fieldi*, Menetr. ♂
B. *Catopsilia crocale*, Cram. ♀
C. *Vanessa cardui*, Linn. ♂
D. *Catopsilia pyranthe*, Linn. ♂
E. *Lampides bœticus*, Linn. ♂
F. *Pieris brassicæ*, Linn. ♂
G. *Danaus hamata septentrionis*, Butl. ♀
H. *Danaus genutiæ*, Cram. ♂
I. *Euplœa core*, Cram. ♂

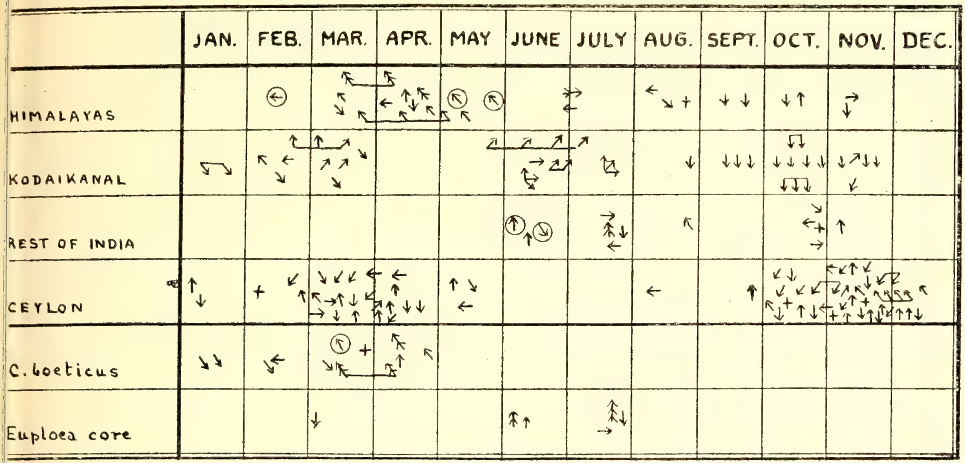

JAN.
FEB.
MAR.
APR.
MAY
JUNE
JULY
AUG.
SEPT.
OCT.
NOV.
DEC.
HIMALAYAS
KODAIKANAL
REST OF INDIA
CEYLON
C. boeticus
Euploea core

Fig. 1.—Diagram showing the date and direction of recorded flights in different parts of India and Ceylon, and also the recorded flights of *C. boeticus* and *E. core* in India.

An examination of Table I and the corresponding portion of Fig. 1 shows that the flights in the foothills of the Himalayas are chiefly in two seasons; the first in March, April and May; the second mid-August to early November; corresponding more or less to the Spring and Autumn. The flights in the Spring season are most frequently to the N.-W. and in the Autumn to the South, as shown in Fig. 2.

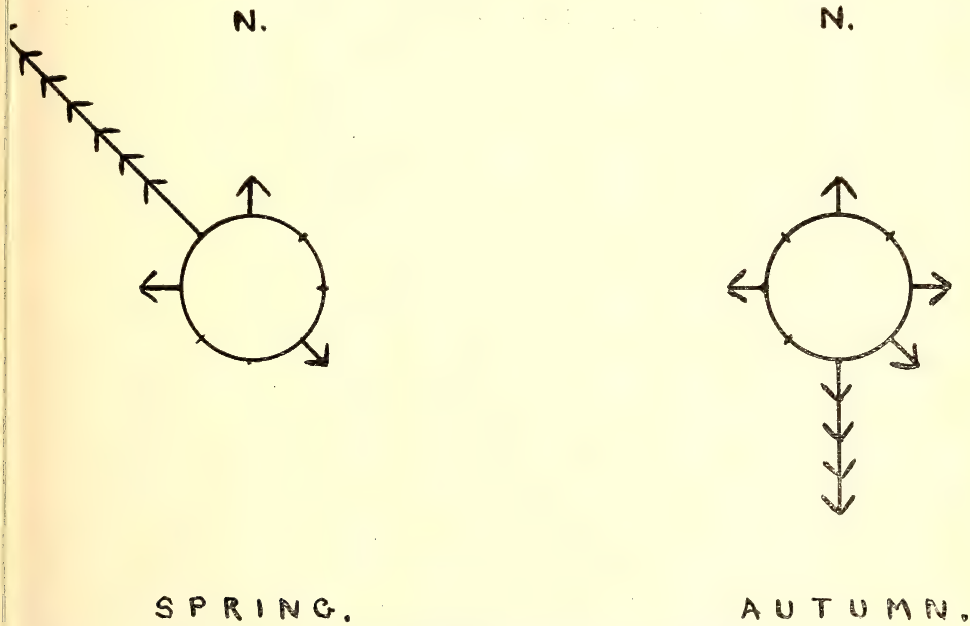

N.
N.
SPRING.
AUTUMN.

Fig. 2.—Diagram showing the directions of the recorded flights of butterflies in the Himalaya region of India separated into Spring and Autumn seasons.

TABLE I.—N. INDIA AND HIMALAYAS.

DATE	LOCALITY	SPECIES CONCERNED	DIRECTION	OBSERVER AND REFERENCE
April	Naini Tal, U.P.	*Lampides boeticus*	To North	Lang (de Niceville 1890).
Spring	Mussoorie	do.	...	Mackinnon (de Niceville 1890).
Annually End June to beg. July	Dehra Dun, U.P.	*Catopsilia crocale* and *C. pyranthe*	Most to West Sometimes to East	Ollenbach (Williams 1930b).
1900 Aug. 12	Palampur, Kangra	*C. crocale* and a few *C. pyranthe*	To East	Dudgeon (1902).
1901 March, April, and Annual	Lucknow Dist., U.P.	*L. boeticus*	To North-West	de Rhé-Philipe (1902).
1901 April 7	Palampur, Kangra	*A. mesentina* and a few *Danaus genutia*	To West	Dudgeon (1902).
1900 August	Shandur Pass, Chitral.	*Vanessa cardui*	To South-East	Evans (Williams 1935).
1908 Mid October.	Naini Tal, U.P.	*Precis iphita*	To South	Peile [See Appendix].
1909 April 16	Mussoorie	*Colias fieldi edusina*	,,	,, ,,
1909 October	Valley of Doone	Unknown	To North	Crothers (Williams 1935).
1912 August 20	Mussoorie	*Catopsilia*	...	Peile (Williams 1928).
1913 April 30	,,	*L. boeticus*	To North-West	Peile [See Appendix].
1913 May	,,	*Spindasis nipalicus*	'Down the nullah.'	,, ,,
1915 November	Kampilong, Darjiling.	*Appias lalage*	To East	Roberts (Williams 1928).
1916 March	Khyber Pass	*Euchloe lucilla*	To South-East	Evans (Williams 1935).
1916 May	Mussoorie	*Papilio agestor*, *Delias sanaca*, *Neptis hylas*, *Parathyma opalina*, *Arhopalas* spp.	To North-West	Peile [See Appendix].
1916 End May	,,	*Delias sanaca* and others	'Down the nullah.'	,, ,,
1916 September	Mussoorie, U.P.	*D. genutia*, *Precis iphita*, *Neptis hylas*, *Lethe vaivarta*, *Papilio polytes*, *Terias læta*, *T. libythea T. hecabe*, *Celastrina puspa Syntaruches plenius*, *Everes argiades*, *Vanessa canace* and others...	To South	,, ,,
1918 2nd half of September	Mussoorie	*Achlarus bifasciatus casyapa*	To South	Ollenbach (Williams 1930b).
1919 End March—May	Dharmsala, Kangra...	*Pieris brassicae*, with *Colias fieldi* and a few *D. chrysippus*, *V. cashmirensis* and *Polyommatus boeticus*	To North-West	Hingston 1928.
1920 ? Feb.	Rawalpindi	*L. boeticus*	To West	Evans 1927 and (Williams 1935).
1924 November	Dehra Dun, U.P.	*Kallima inachus huegelii*	To South	Ollenbach (Williams 1930b).
1928 March 17-25.	Naini Tal, U.P.	*L. boeticus*, and a few *Colias fieldi*...	To North-West	Broughton (Williams 1930b).
1928 Mid April	Dehra Dun, U.P.	*L. boeticus*, (annual event but very		

The species concerned in these flights are given in the following list. An I. after the name denotes that it has also been recorded as migrating in other parts of India, and a C. after the name denotes that it has also been recorded as migrating in Ceylon.

PAPILIONIDÆ.

Papilio agestor.
Papilio polytes. C.
Papilio machaon.

PIERIDÆ.

Euchloe lucilla.
Pieris brassicae.
Delias sanaca.
Glycestha aurota. I.C.
Appias lalage.
Catopsilia crocale. I.C.
Catopsilia pyranthe. I.C.
Terias libythea.
Terias laeta.
Terias hecabe. I.C.
Colias fieldi.

DANAIDÆ.

Danaus tytia.
Danaus genutia. I.C.
Danaus chrysippus.

NYMPHALIDÆ.

Lethe sidonis.
Parathyma opalina.
Neptis hylas.
Kallima inachus.
Precis iphita.
Vanessa cardui.
Vanessa canace.
Aglais cashmirensis.
Phalanta phalantha. I.C.

LYCAENIDÆ.

Syntaruchus telecanus.
Everes argiades.
Lycaenopsis puspa. C.
Lycaenopsis huegelii.
Cosmolyce boeticus. I.C.
Spindasis nipalicus.

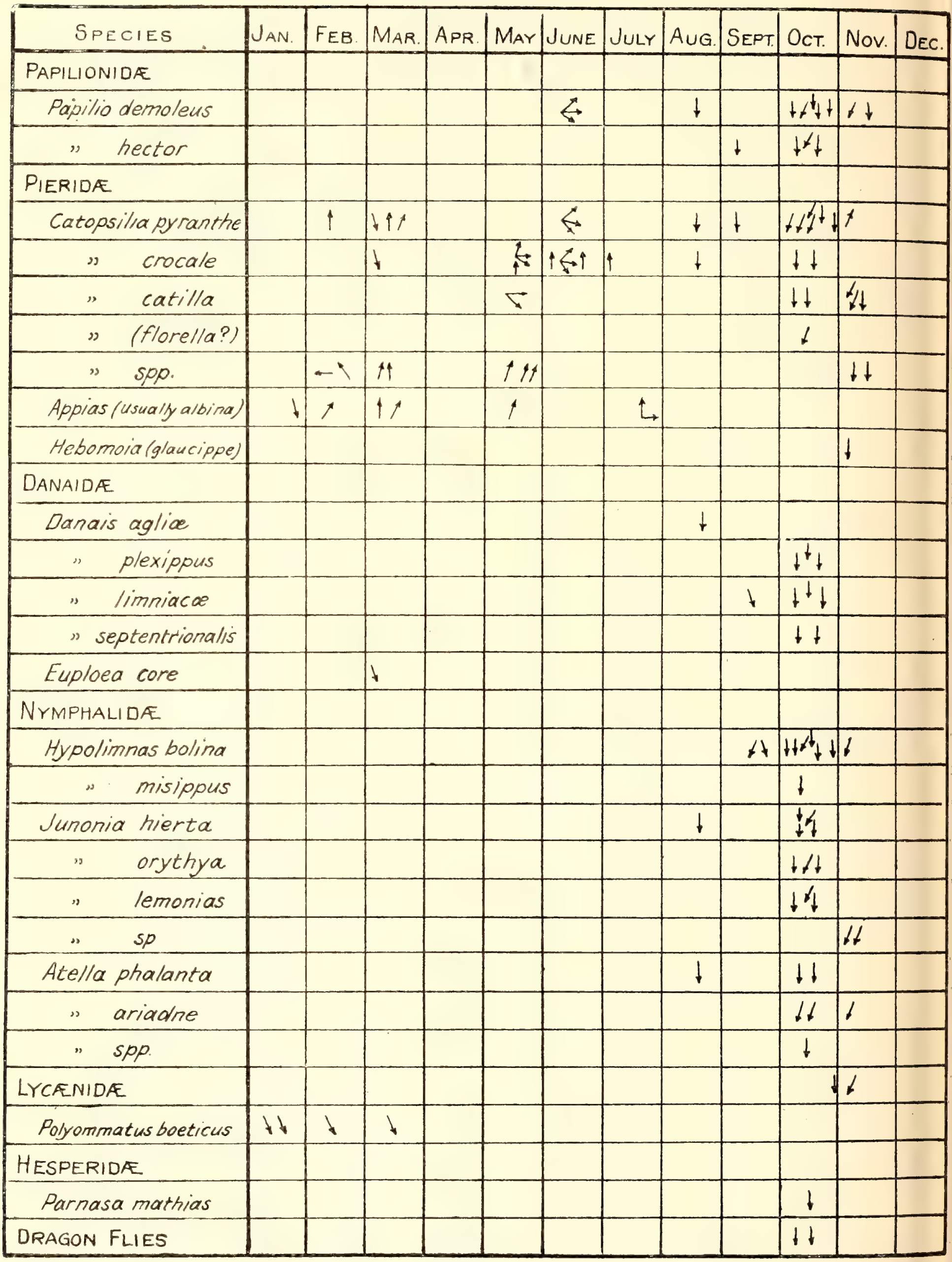
HESPERIDÆ.

Lobocla bifasciatus.

It will be seen that of the thirty-three species recorded, only ten have been seen migrating further south in India or Ceylon.

The most regular migrant of all in this area is undoubtedly *L. boeticus*, the long-tailed Blue (Plate, Fig. E) which has been recorded as migrating by no fewer than nine different observers in India, and by Ormiston in Ceylon (Williams 1927, p. 24). The same species is also known as a migrant in Europe and North Africa and is found in many of the oceanic Islands of the Pacific. The records in the Himalayas are all to the North or N.-W. in February, March and April. At Kodaikanal, Evershed observed four flights in January, February and March, but all to the south or south-east. In Ceylon no exact dates are available.

Another most interesting migrant is *Pieris brassicae*, the Large Cabbage White Butterfly (Plate, Fig. F), which migrates not only in India, but also on a large scale in Europe (see Williams 1930, pp. 112-21). Lefroy (1909) says that in India this butterfly migrates from the hills in the cold weather and early hot weather. It spends this period in the submontane districts of the Himalayas, breeding on cultivated *Crucifers*, and returns to the hills for the summer. Fletcher (1925) says that it first appears at Pusa about the first week in February, and two or three generations are passed through rapidly before the end of April. At the beginning of May all disappear, and do not reappear till the following February. The only observed case of actual migration is that of Hingston (1928) referred to in Table I.



Species	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Papilionidæ												
Papilio demoleus						↗→↘		↓		↓↙↓↓↓	↙↓	
" *hector*									↓	↓↙↓		
Pieridæ												
Catopsilia pyranthe		↑	↘↑↗			↗→↘		↓	↓	↙↙↙↙↓↓	↗	
" *crocale*			↘		↑↖→↘	↑↗→↘↑	↑	↓		↓↓		
" *catilla*					→↘					↓↓	↙↙↓	
" *(florella?)*										↙		
" *spp.*		←↖	↑↑		↗↗↗						↓↓	
Appias (usually albina)	↘	↗	↑↗		↗		↑→					
Hebomoia (glaucippe)											↓	
Danaidæ												
Danais agliæ								↓				
" *plexippus*										↓↓↓		
" *limniacæ*									↘	↓↓↓		
" *septentrionalis*										↓↓		
Euploea core			↘									
Nymphalidæ												
Hypolimnas bolina									↙↘	↓↓↙↓↓↓	↙	
" *misippus*										↓		
Junonia hierta								↓		↓↙↓↓		
" *orythya*										↓↙↓		
" *lemonias*										↓↙↓		
" *sp*											↙↙	
Atella phalanta								↓		↓↓		
" *ariadne*										↙↙	↙	
" *spp.*										↓		
Lycænidæ										↓	↙	
Polyommatus boeticus	↘↘	↘	↘									
Hesperidæ												
Parnasa mathias										↓		
Dragon Flies										↓↓		

Fig. 3.—Diagram showing the directions and months of all flights of butterflies recorded at Kodaikanal, S. India by Mr. J. Evershed, F.R.S.

(Reproduced from the *Trans. Ent. Soc. London* 1927, p. 8 by kind permission of the Society.)

Vanessa cardui, the Painted Lady (Plate, Fig. C), is one of the most widespread of all butterflies and is a regular migrant in both Europe and North America. It occurs throughout India and Ceylon and has been found far out at sea in the Indian Ocean. In Ceylon, Ormiston (1924) says that on occasions it appears suddenly in great numbers but he has no other evidence of migration. Aitken (1897) states that 'At different times of the year, but most often I think in June, large numbers of this species appear about the rocks on the seashore and in other barren situations and I am inclined to think that they are new arrivals from some other country. . . . A certain number remain permanently with us and breed on a common species of *Blumea.*' The only record of an actual flight is the one recorded by Evans in the Shandur Pass, Chitral. (See Table I.)

At Kodaikanal (Table II and Fig. 3) Mr. Evershed observed numerous migrations between 1907 and 1914, and one flight in 1921. About twenty-three species were noted, and the flight seasons fell definitely into three periods. The main flights were towards the south in October and November and included nearly all the observed species (but not *P. boeticus*). In February and March a return flight to the north occurred, but consisted only of *Catopsilia* spp. and *Appias* spp. Then after a blank period in April there was renewed activity in May and June in the same two genera, with some *Papilio polytes,* but the direction of flight was less definite. Of about 22 species observed by Evershed only 5 have been recorded as migrating in the Himalayan area; but all but two species (*Precis orithya* and *Pelopidas mathias*) are known migrants in Ceylon.

TABLE II

Obeservations made by J. Evershed at Kodaikanal, S. India.

DATE	SPECIES	DIRECTION
1907		
February—March ...	*Catopsilia pyranthe* ...	North.
1908		
May 16 to begin. July.	*Catopsilia crocale*	North and N. by E.
October 7–21 ...	Dragonflies, *Papilio demoleus* (enormous numbers), *H bolina, P. hector, Catopsilia crocale, C.? catilla, D. plexippus, limniace* and *septentrionis, Junonia hierta, J orithya, J. lemonias, Atella phalantha*	South.
1909		
March 28 ...	*Euploea core, C. crocale, C. pyranthe*	To South-East.
June 13–15 ...	*C. crocale, C. pyranthe, P. demoleus* and others	East, East by South and North-East.

Observations made by J. Evershed at Kodaikanal, S. India—(*Contd.*)

DATE	SPECIES	DIRECTION
October 3–25	*P. demoleus*, *E. ariadne*, *A. phalantha*, *J. orithya*, *J. hierta*, *J. lemonias*, *H. bolina*, *C. pyranthe*, a few *P. hector* and *Parnara mathias* (great many)	South, South by W., S.S.-W and S.W.
1910	No records	
1911		
Jan. 4–28 and Feb. 19	*Polyommatus boeticus*	South-East.
January 28–30	*Appias albina*	South-East by South.
February 12 and 19	Catopsilias	West and N.-West.
March 12	*Appias* sp.	North-East.
March 19	*P. boeticus* (many)	To South-East.
	Appias, males (several)	North-East.
	Catopsilias (a few)	North.
1912		
Mar. 23, 24, 25, and 28.	*Catopsilia pyranthe* only, in numbers	North by East.
May 19 (about)	*Catopsilia catilla*	E., E.S.E. and S.-E.
	Appias and a few Catopsilias	N. and N. by E.
May 20–29	*Catopsilia catilla* (pale form); on 28th all *crocale*	Mostly E. to S.-E., also some North to North-East.
July 31	Large Catopsilias	Various, but mostly North to East.
September 11	*C. pyranthe* (several), *P. hector* (only one)	South.
September 21	*D. limniace* (5 or 6)	South or South by E.
September 15–29	*H. bolina* (several each day)	Towards S.-W. to S.-East.
October 6	*H. bolina* (large numbers of both sexes)	South and S.S-W.
October 9	*C. pyranthe* (large numbers)	South and S.-W.
October 13	Do do.	More or less S.
October 16	*C. pyranthe* (snow-storm)	
,,	*P. demoleus* (large numbers), *A. phalantha*, *H. missipus* (considerable number of females, a few males), *H. bolina*, *D. plexippus* (1), *D. limniace* (1), *J. hierta* (a few), *J. lemonias* (1), *C. florella*? (a few)	S. (more or less).
October 30	*P. demoleus* (large numbers), *C. pyranthe* (snow-storm), *H. bolina* (a few)	S. (more or less).
October 31	*C. pyranthe*, *P. demoleus*, *Atella* (great many of all)	S. (more or less).
November 3–4	*C. pyranthe* (small number)	North-East.
November 5–6	*C. catilla* (considerable numbers)	S.-W. and W.S.-W.
	P. demoleus (a few), *H. bolina* (a few), *Junonia* sp. (several)	S.-W. (more or less).
November 10	Hebomoias (many), Catopsilias (*catilla* chiefly)	South.
November 14–22	*P. demoleus* and Catopsilias	South.

Observations made by J. Evershed at Kodaikanal, S. India—(*Contd.*)

DATE	SPECIES	DIRECTION
1913		
March 2–9 ...	Catopsilias and *Appias* (a few only)	North.
May 18–31 and June 1.	*Catopsilia crocale, catilla* or *florella* (not *pyranthe*) ...	N.-E. and E.N.-E.
1914		
November 11 ...	*Catopsilia catilla* (considerable numbers), also *E. ariadne*, Junonias, *Atella phalantha* ...	West and W. by S.
1915–20	No records	
1921		
August 21 ...	*C. pyranthe* (many), also *C. crocale, P. demoleus* (many), *A. phalantha* (many), *D. aglea* (a few), *J. hierta* (a few)	South.

The October-November season at Kodaikanal corresponds to the change of the S.-W. to the N.-E. monsoon and is the period of maximum rainfall.

In the remainder of India (Table III, p. 449) there are only nineteen recorded flights, of which at least 12 refer to butterflies of the family *Danaidae*, and chiefly to *Euploea core*. The flights of this species seem to occur fairly regularly in the Bombay area in June and July and are chiefly towards the north. It has never been recorded in the Himalayan area, and only once at Kodaikanal, but it regularly joins in the flights in Ceylon in November and December, and again to a smaller extent in March and April.

All the localities at which butterfly migrations have been recorded in India are shown in Fig. 4 together with the direction of flight. They are well scattered over the country, but there are still very large areas from which no information is available.

A general survey of the evidence available for India thus shows that we have about eighty records of unidirectional flights over the whole country, of which about half are due to Mr. Evershed at Kodaikanal.

These records include 52 species (see table IV, p. 450) of which 27 are also known to migrate in Ceylon.

When it is realised that for the Cabbage White Butterfly, *Pieris brassicae*, we have a hundred records of flights for England alone, and another hundred for the Continent of Europe, and that for the Painted Lady (*Vanessa cardui*) we have about 400 records in different parts of its range, it will be seen that the problem in India is in a very early stage of investigation.

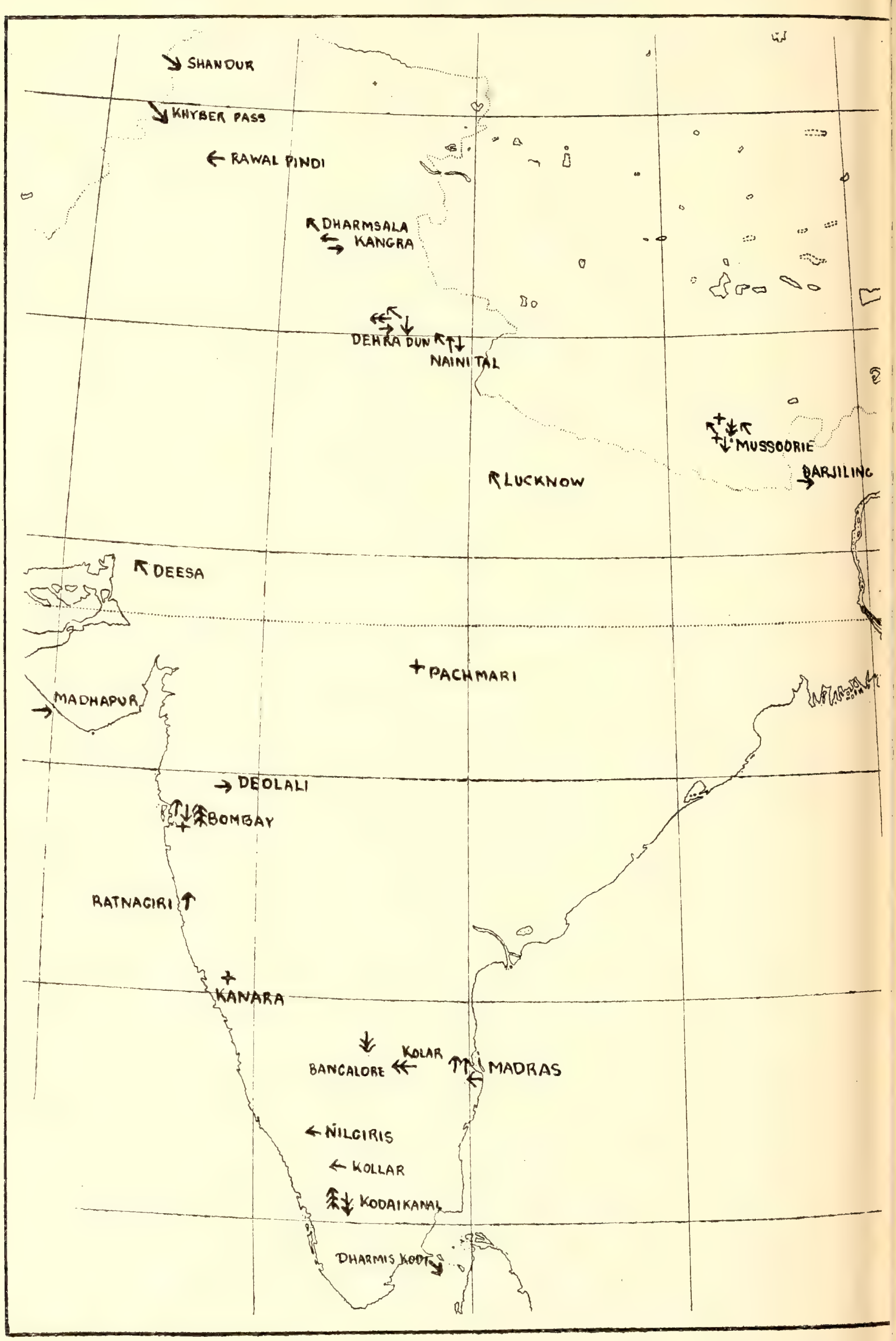

SHANDUR
KHYBER PASS
RAWAL PINDI
DHARMSALA
KANGRA
DEHRA DUN
NAINI TAL
MUSSOORIE
DARJILING
LUCKNOW
DEESA
PACHMARI
MADHAPUR
DEOLALI
BOMBAY
RATNAGIRI
KANARA
KOLAR
BANGALORE
MADRAS
NILGIRIS
KOLLAR
KODAIKANAL
DHARMIS KODI

Fig. 4.—Map of India showing localities and directions of the recorded flights of butterflies.

TABLE III.—REST OF INDIA.

Date	Locality	Species	Direction	Observer and Reference
..	Siddapur, N. Kanara.	Danains	...	Prall 1898.
Several years	Bangalore	Danains, Euplœas, Catopsilias	To South	Kuhni Kannan (Williams 1929b).
,,	Kolar Gold Fields, Mysore	Danains	To West	Rowntree [See Appendix].
Many years, about begining June	Bombay	*Euploea core*	To North	Aitken 1898.
1897	Ratnagiri, Bombay	do.	do.	Aitken 1897.
1897 October 21	Mody Bunder, Bombay	do.	...	Prall 1898.
1898 July 26–27	Bombay	do.	To S (only time seen in this direction)	Aitken 1898.
1900 July 22	,,	do.	To North	Aitken 1900.
1901 Aug. 25–27	Deesa, Bombay	*Catopsilia pyranthe*	To North-West	Nurse 1902.
1908 October 18	Nilgiris	Euplœas	To West	Andrewes 1910.
1909 July 26	Madras	*Danaus septentrionis*	do.	Punnett (Williams 1935).
1912 November 3	,,	Mostly Catopsilias	To North	Patton (Williams 1927b).
1918	,,	Catopsilias and Danains	do.	Hopkins (Williams 1928).
1920 about June	Kellar, Nilgiris	Danains	To South-East	Parlett [See Appendix].
1921 October 28	At sea five miles off Madhapur	*A. mesentina*, *Teria hecabe* *P. demoleus*, *E. core*, *D. genutia*, *Precis hierta*, *H misippus*, *P. aristolochiæ*, *Teracolus*, *amatus*	To East	Wall 1921.
1922 July	Deolali, Bombay	*E. core*	do.	Tulloch (Williams 1930b).
1922 September	Pachmari, Cent. Prov.	*C. crocale*, *C. pyranthe*, *T. hecabe*, etc.	...	
1932 October 30	Dhamiskodi	Dark butterflies	To South-East	Hinchey (Williams 1935).
1937 June 13	Bombay	*Euploea core*	To North	Ghose [See Appendix].

TABLE IV.—INDIAN BUTTERFLIES RECORDED AS MIGRANTS.

PAPILIONIDÆ.

**Papilio hector* L. :—Evershed.
**Papilio aristolochiæ* Fabr. :—Wall.
Papilio agestor Gray :—Peile.
**Papilio polytes* Linn. :—Peile.
**Papilio demoleus* Linn. :—Wall, Evershed.
Papilio machaon Linn. :—Peile.

PIERIDÆ.

Euchloe lucilla Butler :—Evans.
Pieris brassicæ Linn. :—Hingston, Lefroy, Fletcher (Plate, fig. F).
Delias sanaca Moore :—Peile.
**Glycestha aurota* Fab. (*mesentina* Cr.) :—Dudgeon, Wall.
Appias lalage Dbdy. :—Roberts.
**Appias albina* Bdv. :—Evershed.
**Catopsilia crocale* Cr. :—Dudgeon, Ollenbach, Evershed (Plate, fig. B).
**Catopsilia pomona* f. *catilla* Cr. :—Evershed.
**Catopsilia pyranthe* Linn. :—Dudgeon, Ollenbach, Nurse, Evershed. (Plate, fig. D).
**Catopsilia florella* Fabr. :—Evershed.
Terias libythea Fab. :—Peile.
Terias læta Bdv. :—Peile.
**Terias hecabe* Linn. :—Peile, Wall.
Colias fieldi Men. :—Hingston, Broughton, Peile (Plate, fig. A).
Colotis amata Fabr. :—Wall.
Hebomoia glaucippe Linn. :—Evershed.

DANAIDÆ.

**Danaus aglea* Cram. :—Evershed.
Danaus tytia Gray. :—Peile.
**Danaus limniace* Cram. :—Evershed.
**Danaus hamata septentrionis* But. :—Punnett, Evershed (Plate, fig. G).
Danaus genutia Cram. :—Dudgeon, Peile, Wall, Evershed. (Plate, fig. H).
Danaus chrysippus Linn. :—Hingston.
**Euplœa core* Cram. :—Aitken, Prall, Wall, Tulloch, Ghose, Evershed. (Plate, fig. I).

NYMPHALIDÆ.

SATYRINÆ.

Lethe sidonis vaivarta Doherty :—Peile.

NYMPHALINÆ.

Parathyma opalina Koll. :—Peile.
Neptis hylas Linn. :—Peile.
**Hypolimnas misippus* Linn. :—Wall. Evershed.
**Hypolimnas bolina* Linn. :—Evershed.
Kallima inachus Bdv. :—Ollenbach.
**Precis hierta* Fabr. :—Wall, Evershed.
Precis orithya Linn. :—Evershed.
**Precis lemonias* Linn. :—Evershed.
**Precis iphita* Cram. :—Peile.
**Vanessa cardui* Linn. :—Evans. (Plate, fig. C).
Vanessa canace Johann. :—Peile.
Aglais cashmirensis Kollar. :—Hingston.
**Phalanta phalantha* Drury. :—Peile, Evershed.
**Ergolis ariadne* Moore. :—Evershed.

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* Also recorded as migrating in Ceylon.

LYCAENIDÆ.

Syntaruchus telecanus plinius Fabr. :—Peile.
Everes argiades Ever. :—Peile.
Lycænopsis huegelii Moore. :—Peile.
**Lycænopsis puspa* Hors. :—Peile.
**Cosmolyce bœticus* Linn. :—Lang, McKinnon, Hingston, Peile, Evans. de Rhe-Philipe, Broughton, Ollenbach, Evershed. (Plate, fig. E).
Spindasis nipalicus Moore. :—Peile.

HESPERIDÆ.

Lobocla bifasciatus casyapa Moore. :—Ollenbach.
Pelopidas mathias Fabr. :—Evershed.

OBSERVATIONS REQUIRED.

What is needed at the moment is a very great increase in the number of observers who will watch out carefully for any directional flights of butterflies, whether in large or small numbers; and who will send in their observations and specimens to the writer of this article or to the Curator of the Bombay Natural History Society.

The information required is first of all the locality, date and direction of flight, and secondly a number of specimens of the insects concerned, taken actually from the flight. Such specimens add very greatly to the value of the record, as from them identifications of species and variety can be obtained and dissections made to see the state of development of the eggs or ovaries. One or two specimens are much better than none; and, if opportunity occurs to catch them, up to fifty is not too many. The condition of the specimens is not of major importance, and for our immediate purpose a single broken specimen, or even a wing, enclosed in a letter is better than a perfect one which has escaped.

The best way to kill such specimens is to give the insect a sharp pinch at that part of the body where the wings and legs join it (technically the *thorax*). The wings can then be folded back and the butterfly placed in a small paper envelope, or between two sheets of paper in a flat cigarette tin.

If it is not possible to obtain specimens,—if for example the flight is seen from a railway train—, then as full as possible a description of the butterfly should be sent, giving approximate size and colour, whether with or without tails on the wings, etc. Records without specimens are always of interest, as are records of flights seen in the past if locality or date can be fairly well recollected.

Over and above the records of place, direction and date, the observer may send in almost any other details that occur to him. It is not desirable to have information too stereotyped and confined to certain channels, but it is always interesting to know such facts as the direction of the wind; the height of the insects above the ground; the approximate speed of flight; the time of the day; the weather conditions preceding and during the flight; how long the flight lasts and how many insects are estimated to be passing (e.g. dozens, hundreds, thousands, millions). Special watch should also be made to see if more than one species is present and, if this is so, specimens of all species should be captured, if possible, with an estimate of their relative abundance.

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* Also recorded as migrating in Ceylon.

Flights occur also in other groups of insects as well as butterflies. Fraser in 1916 described a large flight of Hawk moths (*Sphingidae*); and the serious pest *Agotis ypsilon* has already been mentioned as a migrant. The latter species is more fully discussed in my previous review (Williams 1930 b).

Dragonflies are also known to migrate in large numbers in many parts of the world but I have no record at present of any migration in India except the record by Evershed in October 1908 (Table II).

Since the above was written I have found another old record of butterfly migration in India. E. L. Arnold (1893) describes a flight of butterflies passing 'on a soft N.-E. breeze' in the Anamalai Hills, south of Palgat, Madras. The flight was apparently about mid-November but the year is not stated. The butterflies concerned were said to include *Papilio erithonius, Papilio pammon* (a male from *Papilio polytes*) and many Pieridae.

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APPENDIX

SOME UNPUBLISHED RECORDS OF BUTTERFLY MIGRATION IN INDIA.

(1) DANAIN BUTTERFLIES IN EAST MYSORE.

Dr. W. B. Rowntree writes to me that large migrations of butterflies occur regularly in the district of Champion Reef, Kolar Gold Fields, East Mysore, all flying to the West. Writing on the 9th September 1936 he says that the flights are expected 'in about two months time'. He also adds that he is told that they cross the Western Ghats and may be seen in clouds flying out to sea.

The species were said to resemble illustrations of *Danaus septentrionis* and *D. genutia*, but no specimens were sent from an actual flight.

(2) DANAIN BUTTERFLIES AT KOLLAR, SOUTH INDIA.

Mr. L. M. Parlett informs me that in 1920 about June he saw a large flight of Danain butterflies at Kollar in the Nilgiri Hills, South India, flying to the south-east. The flight appeared to consist almost entirely of *Euploea core* and *Euploea coreta,* and was so thick that the sky looked as if full of drifting brown leaves.

Kollar is said to be about 1,200 feet altitude at the foot of the Nilgiri Hills and about 4 miles from Mettupalayam.

(3) EUPLOEA ASELA AT BOMBAY.

Miss A. Ghose informs me that on 13th June 1937 a great swarm of butterflies passed over 'Black Bay' Reclamation, Bombay, flying towards the north. The flight lasted from 10 a.m. to noon and the number of insects was estimated at 30,000. Their speed was about 4 miles per hour and they flew at a height of from 4-60 feet above the ground. The wind was from the S.W. (Monsoon) and the sky fairly clear with bright sunshine.

Miss Ghose sent me two specimens, both of which were *Euploea asela.*

(4) VARIOUS BUTTERFLIES AT MUSSOORIE IN SEPTEMBER 1916.

Lt.-Col. H. D. Peile kindly sends me the following information.

On the 20th September 1916 at Mussoorie—United Provinces, India, on the southern slopes of the Himalayas at a height of about 7,000 feet. Misty, with sunny intervals during which the following species were seen migrating from north to south against the wind.

DANAIDÆ.

Danaus genutia, common.

NYMPHALINÆ.

Precis iphita, very common.

Neptis hylas astola, wet season form. Eight taken evidently recently emerged, all the usual rather small size.

SATYRINÆ.

Lethe vaivarta, several.
**Callerebia scanda*, female captured, other worn ones seen.
**Callerebia hyagriva*, very worn female.

PAPILIONIDÆ.

Papilio polytes, seen.

PIERIDÆ.

Terias laeta, several.
Terias libythea, several.
Terias hecabe,

LYCAENIDÆ.

Celeastrina puspa, two females taken.
Syntarucus plinius, female.
Everes 'argiades' females. (May have included *E. dipora* and *E. diporides*).

On 21st September at same spot. Sunny with occasionally mist. Migration as yesterday including the following.

DANAIDÆ.

Danaus tytia, one seen near thistles.
Danaus genutia, two.

NYMPHALIDÆ.

Argynnis hyperbuis, female.
Neptis astola, nine of wet season form.
Precis iphita, very common.

SATYRINÆ.

Lethe vaivarta, three.
**Callerebia scanda*, two.

PIERIDÆ.

Terias hecabe, several.
Terias libythea, three.
Terias laeta, thirteen.

PAPILIONIDÆ.

Papilio polytes, ♀ form *cyrus* 1. ♀ form *polytes* 1.
Papilio machaon, several.

LYCAENIDÆ.

Celestrina puspa, two females.

Heavy rain followed on 24th, 25th and 26th September.

On October the 6th and 7th, 1916, at Fox's Hill, about 3 miles west of the previous locality, the stream of migration from north to south was continuing and included the following species.

DANAIDÆ.

Danaus tytia, one seen.
Danaus genutia, taken.

NYMPHALINÆ.

Phalanta phalantha, two.

Neptis astola, wet season form very common, several passing every few seconds.

Kallima inachus, one of the dry season form.

Vanessa canace, very common.

SATYRINÆ.

Aulocera saraswata,

LIBYTHEINÆ.

Libythea myrrha,

PIERIDÆ.

Terias libythea, both wet and dry season form.
Terias laeta, abundant.
Terias hecabe, common, many small.

On October 9th the migration continued as before including *Neptis hylas astola* and *Terias* spp.

With regard to the species marked with an asterisk, Lt.-Col. Peile states that these Satyrids have probably merely got mingled locally with the crowd of migrants.

(5) PRECIS IPHITA NAINI TAL, U.P. IN 1908.

Lt.-Col. H. D. Peile informs me that at Naini Tal, in mid-October 1908 *Precis iphita* was very common migrating from north to south over the crest of the mountain at about 8,000 feet.

(6) POLYOMMATUS BOETICUS AT MUSSOORIE IN APRIL 1913.

Lt.-Col. H. D. Peile informs me that large numbers of *P. boeticus* were passing from south-east to north-west at Mussoorie, on 30th April 1913 on the ridge about 5,500 to 6,000 feet above sea level.

(7) VARIOUS BUTTERFLIES AT MUSSOORIE, IN MAY 1916.

Lt.-Col. H. D. Peile kindly gives me the following notes:—

Mussoorie, North-West Himalayas, 3rd May 1916.

In Pumping Station Nullah, above the Pumping Station i.e. above 5,000 feet. Sunny day. Stream of butterflies passing down the nullah, i.e. towards the north-west. The following species were noted.

LYCAENIDÆ.

Arhopalas (*A. dodonsea*, *A. rama* and *A. ganesa*) in worn condition. *Celastrina* (*Cyaniris*) *huegelii,* both sexes common though males more so than females.

NYMPHALIDÆ.

Parathyma opalina, both sexes very common.

Neptis hylas astola, sporting with the above. Wet season form common; the dry season form with yellow underside less so.

Argynnis lathonia issaea, one unexpectedly taken as it flew down the nullah.

PAPILIONIDÆ.

Papilia gestor ssp. *govindra*, two seen.

PIERIDÆ.

Delias sanaca (one captured).

Lt.-Col. Peile adds 'I was catching specimens so often and others going past so numerously that I could not even pin them in a box, but had to drop them on a rock.'

(8) SPINDASIS NIPALICUS (LYCAENIDAE) AT MUSSOORIE IN MAY 1913.

Lt.-Col. H. D. Peile informs me that *Spindasis nipalicus* (=*zaffra*) was very numerous at the Pumping Station nullah at an altitude of 5,500 feet, at Mussoorie, N.-W. Himalayas, in May 1913. On 24th May, a clear sunny day, over 30 were captured by three collectors and many more seen; on 25th May 25 captured by Lt.-Col. Peile alone. These were among a stream of butterflies moving down the nullah and presumably migrating. They were usually not plentiful in this district and Seitz says 'I do not recall any excursion on which I have obtained more than one specimen'.

(9) DELIAS SANACA (PIERIDAE) AND OTHER SPECIES AT MUSSOORIE IN MAY 1916.

Lt.-Col. H. D. Peile informs me that there was a definite movement of various species of butterflies at Mussoorie at the end of May 1916, at the Pumping Station nullah.

On the 23rd May. Hot sunny day. 'A wonderful stream of butterflies from about 9-45 a.m. (or earlier), slackening about 11-30 a.m.'

24th May. Bright hot day. Less variety about than yesterday.

29th May. Same locality, violent wind and dust storms all night. Wind and some cloud and rain threatening today. Fair number of butterflies, but the wind sometimes drove them up the nullah and out of reach of the net.

These hot days preceded the break of the rains. Included in the flight were a number of *Delias sanaca* which came steadily down the nullah in ones and twos in a leisurely way.

10. Lt.-Col. H. D. Peile informs me that on 16th April 1909 at Mussoorie, *Colias fieldi edusina* was abundant and apparently migrating from north to south.

WHERE DID THE SANDALWOOD TREE (*SANTALUM ALBUM* LINN.) EVOLVE?

BY

C. E. C. FISCHER.

As far back as written records go, sandalwood has been known and used in India and China. The heartwood of the sandal tree contains a highly scented oil with medicinal properties which is extracted by distillation. Both the wood itself and the extracted oil have been used for many purposes. Thus:

The Chinese use the wood for making the 'joss sticks' that give forth an aromatic incense and are burnt in temples. In some Polynesian islands the oil (from other species of *Santalum*) is mixed with coconut oil to render it more pleasing. The Malays mix it with other substances to scent their steam baths. They also use it in ceremonial fumigation before prayers and in the ceremonial purification of a corpse. Mixed with *Aquilaria*, the extract is poured out as a libation at the grave-side. In Burma the oil is in demand for use in cosmetics. Hindus make use of a paste made from the wood in making 'caste marks', and the oil in perfumery. The wood is burnt in funeral pyres; every such pyre should include at least one stick of sandalwood, whereas a wealthy family may make the whole pyre of nothing but this wood. Devout Parsis daily add chips or billets of the wood, according to their means, to the everlasting ceremonial fire. The oil has been employed for embalming and in Europe its chief importance is for perfumery and in the manufacture of scented soaps.

Medicinally, sandalwood and its oil have a wide application, and in the East have been considered as a universal panacea. The oil is reputed to have bitter, cooling, astringent, cardiac and tonic properties. It is said to be useful against biliousness, vomiting, fever, thirst and heat of the body. An emulsion made of the wood is applied to the skin as a cooling agent in erysipelas, prurigo and sudamina. The wood ground up with water into a paste is applied to local inflammation and to the temples for the cure of headaches and fever, to skin diseases and to allay heat and pruritus. It is also a diaphoretic, alexipharmic and aphrodisiac and is used in cases of gonorrhœa.

The wood is used for carving, for idols and for boxes prized for their scent.

As far as I am aware, the first published suggestion (with the exception of an inferential one to be mentioned later) that *Santalum album* Linn. may be an exotic in India was that made by myself in the *Kew Bulletin of Miscellaneous Information* for 1927 (page 200). It has always been taken for granted that this tree is truly indigenous in South India. Bias in favour of the universally accepted is natural; therefore, I appeal to all who wish to consider the subject scientifically to set aside prejudice and endeavour to form an opinion in the light of the arguments set out below.

I may, perhaps, be allowed a few words of personal explanation. A few months after being placed in charge of the North Coimbatore Forest Division of the Madras Presidency in 1905, when for the first time I came into contact with the Sandal tree as a component of the forest, the conclusion that it was not an indigenous tree forced itself upon me; an idea based on local observation. I had then, however, no facilities for proving or disproving the theory. It was not till 1927 that the opportunity came. By then I had joined the botanical staff at the Herbarium at Kew and my colleagues Messrs. T. A. Sprague and V. Summerhayes, who were preparing a note on the habitat of certain genera of the *Santalaceae,* pointed out to me the irregular distribution of *S. album.* I then wrote a brief appendix to their paper (quoted above) setting out my conviction and giving a few points in support, but time did not permit of a full enquiry. At the instance of Mr. W. S. Millard, I took the matter up again and during the past year or so I have examined every source that promised information and have also consulted by correspondence a number of workers in various fields with gratifying results.

To clear the ground, it will be as well to enumerate the localities in which Sandal grows at the present time, excluding those where it is obviously cultivated. In India we can accept Mysore as the focus with the adjacent parts of the Madras and Bombay Presidencies and of Coorg. In the Malay Archipelago it occurs in the central and eastern parts of Java and in the islands of Madura, Bali, Sumba, Sau, Watar, Rota, Kisar, Timor and some of the small islands adjoining these, and also at one place in West Central Celebes.

In some of these places it is fairly certain that it has been introduced, especially around ancient Hindu temples, but it is undoubtedly indigenous in Timor and Sumba, whence it was reported by the very earliest botanists in these regions.

EVIDENCE IN FAVOUR OF AN INDIAN ORIGIN.

In the first place, it must be observed that any reference of a later date than about 1750 is of little value, since there is no dispute about the existence of sandal in quantity subsequent to this period and we know through Buchanan and others that it was well established in Mysore before the beginning of the 19th Century.

Chandana—the Sanskrit name ascribed to *Santalum album* Linn. —was known and used in India from the earliest historic times; it is frequently mentioned in the ancient Sanskritic writings. Some of these writings date probably from before the Christian era and from them it appears that the wood was the product of the Malaya Mountains of Southern India. To quote all the apposite extracts that I have obtained would swell this essay to undue proportions, but it will be useful to cite some of them.

The *Ramayana*, referring to the river Tambrapani (Tāmraparni) says: 'That river with its islands covered with fair forests of sandal goes down to the sea as a beloved maid to her lover.'

In his epic poem, *Chilappatikaram*, Ilanko-Atikal, the Tamil poet who wrote sometime between the 2nd and 5th Centuries of our era, speaks of 'Sandal born in the Southern Mountain' (Malaya *Tenmalai piranta chantanam*).

Kalidasa, not later than the 5th Century A.D., refers in several passages to sandal being derived from South India, notably in his epic poem *Raghuvamsa*, where he states: 'The neck-halter of elephants that break their foot-chains did not slip, being fixed in the marks made by the coiling serpents round the sandal trees' (iv, 48) '. . . the two mountains Malaya and Dardura which have sandal forests on their peaks . . .' (iv, 51); '. . . dally ever on the uplands of Malaya, strewn with Tamāla leaves, where the sandal-trees have cardamon-creepers clinging to them and the betel-trees (Pūga) are girt about with Betel-creeper (Tāmbūla).

In the *Panchatantra* (not later than the 5th Century A.D.) we find: '. . . the sandal does not flourish anywhere else except on Malaya.' (i, 42.)

Rājaśēkhara (880-920 A.D.) in his *Kāvya-mīmāmsā*, speaking of the Malaya Mountain, says: 'It is the home-land of the delightful true sandal . . . sandal trees encircled as far as the root-system by hooded snakes, Jāti-trees (*Ficus?*), together with *kakkolaka* (nutmeg) and cardamoms and pepper-trees.'

Monier-Williams cites *Hitopadesa* II verse 163 in reference to the sandal-tree: 'The root is infested by serpents; the blossoms by bees; the branches by monkeys; the summit by bears. In short there is no part of the sandal-tree which is not occupied by the vilest impurities.'

In the *Periplus of the Erythrean Sea*, written in the 2nd Century, we read that '. . . sandalwood, teak, ebony and blackwood were imported from Baragaza (Broach) in Western India to Apologus, an important harbour at the mouth of the Euphrates.'

Chapter XI of Kautilya's *Artha-śāstra* (attributed variously to dates between 320 B.C. and 300 A.D.) includes sandal among the 'objects that are entered into the treasury'.

Sandal is mentioned as an article of toilet in the Buddhist *Jatake* stories of the 7th Century B.C.

Finally, we know that sandalwood was one of the articles of commerce brought from India to the Roman Empire.

I have, however, found no reference of a clear and unmistakable nature to sandal growing in India, except as an admittedly planted tree, up to about the year 1780 when Francis Buchanan (later Buchanan-Hamilton) visited the State of Mysore and the adjoining territories in about 1800 and wrote an account of his travels (*A journey from Madras through the countries of Mysore, Canara and Malabar* by Dr. Francis Buchanan published in 1807). He made numerous references to the sandal tree, which at that time was to be found in quantities in many places visited by him. It is clear that sandal had been abundant there for some years before, since he states (vol. ii, 536) that: 'The quantity [of sandalwood] brought from Coorg during the years 1792 to 1798 amounted to about 12,000 candies.'

Such is the evidence for the existence of the living sandal tree in India; and now what is its value?

In the first place it is to be noted that there is no certainty that what is now termed *Chandana* is the same plant or material that was recognised by the same name a thousand years ago. Everyone who was had to deal with vernacular plant-names is well aware of the vagueness of their application : often the same name is used for different plants in different, though adjacent, localities; or more than one name may be attached to the same plant. Even at the present time there is confusion in the commercial names of timbers. Thus, according to Meyer (*Buch der Holznamen*), the woods of the following four species are termed 'sandalwood' : *Santalum album* Linn. ; *Lepidaglaia Bailloni* Pierre ; *Mansonia Gagei* J. R. Drumm. ; *Adenanthera pavonina* Linn.—besides that of other species of *Santalum* and of allied genera. The woods of *Pterocarpus santalinus* Linn.f., *Caesalpinia Sappan* Linn. and *Ximenia americana* Linn. are known as 'False sandal'. Substitutes for and adulterants of sandalwood are frequently used. These include: *Erythroxylon monogynum* Roxb., *Aquilaria Agallocha* Roxb. (the Eagle- or Aloe-wood which has been an article of trade in and with India from a very early historical date), *Excaecaria Agallocha* Linn., *Euphorbia antiquorum* Linn., *Cordia fragrantissima* Kurz (vernacular *Sandawa*) and *Mansonia Gagei* J. R. Drumm. (see Kew Bulletin 1933, page 3).

At an early period a number of differing kinds of *Chandana* were recognised besides the 'yellow' and 'white' (*Santalum album*) and the 'red' (*Pterocarpus santalinus*). In some cases the different names were an indication of localities from which they came, e.g. : Malayaja or born in the Malaya Mountain ; Srikhanda ; Ghandaraja ; Ghandasara ; Vavara ; Tailaparna ; Gosirsa ; Batal and Sukhad. But often the names evidently referred to differing qualities. Thus Kautilya in *Artha-śāstra* chapter xi, which is concerned with the objects that are to be entered in the treasury, gives the following interesting passage: '(as to) *Chandana* (sandal) :

Santana is red and smells like rain-moistened earth ; Gōśīrshaka is dark-red and smells like fish ; Harichandana is of the colour of the feathers of a parrot and smells like tamarind or mango fruit ; likewise Tarnapasa ; Grāmeruka is red or dark-red and smells like the urine of a goat ; Daivasabheya is red and smells like a lotus flower ; likewise Aupaka (Jāpaka) ; Jongaka and Taurupā (these are the products of the country of Kāmarūpa, Assam) are red or dark-red and soft ; Māleyaka is reddish-white ; Kuchandana is as black as Agaru (resin of the aloe) or red or dark-red and very rough ; Kālaparvataka is of pleasant appearance ; Kośākāraparvataka (that which is the product of that mountain which is the shape of a bud) is black or variegated black ; Sītōdakīya is black and soft, and smells like a lotus flower ; Nāgaparvataka (that which is the product of Naga Mountain) is rough and is possessed of the colour of Saivala (*Vallisneria*) ; and Śākala is brown.'

Now it can hardly be contended that all these articles are one and the same and are all referable to *Santalum album* Linn. Nor is it in the least likely that this latter tree will be found in association with the *Areca* palm, cardamoms and pepper, nor has it ever been known in Assam.

Reference must also be made at this point to the work of Garcia da Orta (*Colloquies on the simples and drugs of India,* published in 1562; Markham's translation, page 399) states: 'The Malayalims also say that they have a scented wood which is like white sandal, and they anoint themselves with it for fevers. They call it Sambarane.'

Then Christoval Acosta (*Tractao de las drogas y medicinas de las Indias Orientales*, 1578), who copied much from Garcia da Orta, but added some matter of his own, wrote (page 170): 'Another scented wood which much resembles the white sandal, is to be found in certain parts of the coast of Melinde and the island of S. Llorante and in some parts of Malabar: with this the blacks anoint themselves against fevers, but none of these is sandal nor has it its qualities. I saw this scented wood in Malabar (which is called among other names Sambarane), at Tanor and at Cranganor, but it is not sandal nor do the doctors of these lands hold it for such.'

Unfortunately I have so far failed to trace what this Sambarane[1] may be.

The fact that the true sandal was exported from Indian ports westwards during the period of the Roman Empire and later is not conclusive, for we know that these ports, and Calicut in particular, served as clearing houses for the products brought from further East. For example; Gibbon (*Decline and Fall of the Roman Empire.* Everyman Edition, vol. i, page 55), writing on the trade with the East from a port in the Red Sea, says: 'The Coast of Malabar, or the Island of Ceylon, was the usual term of their navigation, and it was at these markets that the merchants from the more remote countries of Asia expected their arrival.' Moreland and Chatterjee (*A Short History of India* by W. M. Moreland, C.S.I., C.I.E. and Sir Atul Chandra Chaterjee, G.C.I.E., K.C.S.I.) give similar evidence. Garcia da Orta (l.c. pages 397 and 398) has the following illuminating passages: 'The City of Calicut, where all kinds of merchandise were brought and sold, was celebrated in these parts. Thither goods were brought from elsewhere, and the Chinese came with their trade, including sandal which they sold there, whence it was taken to the West. I have told you that the Chinese factory, called Chinacota, in which the Chinese reside, is today still established there. . . . This is the reason why Antonio Musa said that sandal grew in the plain of Calicut. There is no plain in Calicut, but palm groves along the beech, and hills inland.'

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[1] 'Sambarane' is evidently *sāmbrāṇi*, the Dravidian name for gum-benzoin and the tree that produces it, *Styrax Benzoin* (Canarese, Malayalam, Tamil, Telugu). By extension the name is given to such balsamiferous trees as *Boswellia serrata* (Canarese, Tamil) and *Canarium commune* (Canarese), and to their products [J. F. CAIUS].

It is true that modern authors refer to *Santalum album* as a native of India and even correct the older authors in some cases as to the derivation of sandalwood, but this is simply because they know that it now grows freely in some parts of Peninsular India and no one had suggested that it had not grown there from all time.

EVIDENCE OPPOSED TO AN INDIAN ORIGIN.

In Abul Fazl's (1551-1602 A.D.) *Ain-i-Akbari*, vol. i, Ain 30, page 81, we read: '9. Sandalwood called in Hind *Chandan.* The tree grows in China. During the present reign, it has been successfully planted in India.' Too much stress must not be placed on the word China, for in those days of comparative geographic ignorance it was a generalised term comprehending all lands east of Sumatra. In any event, it is obvious that the author was in no doubt that the tree referred to did not grow naturally in India. By virtue of his position as Akbar's Minister of State and his training Abul Fazl was, above all men of that time, specially fitted to obtain correct information; moreover he is reputed to have been particularly trustworthy.

Garcia da Orta (l.c. page 399) also refers to the introduction of the sandal tree, he wrote: 'I would have you also to know that the sandal tree is found in other parts: I saw it in Amdanaga [Ahmednagar] where it was brought to be sown . . . I saw there at a pleasure house . . . trees of sandalwood.'

It is unnecessary to make room here for all the references I have found testifying to the occurrence of *Santalum album* in the Malay Archipelago and to its import into India, and I will confine myself to a few, citing others in an appendix.

Cosmas (*Indicopleustes*; written about 545 A.D. Hakluyt Society vol. 98, page 363), concerning Taprobane [the ancient name of Sumatra] states: '. . . is much frequented by ships from all parts of India and Persia and Ethiopia, and it likewise sends out many of its own, and from the remotest countries, (the countries inside Cape Comorin, that is, east of it), I mean Tzinista and other trading places it receives silk, aloes, cloves, sandalwood and other products and these are passed on to marts on this side, such as Male [the Malabar littoral] and to Calliana [Kalyan near Bombay] . . . to Sindu . . . and to Persia.'

Ebn Baithar, somewhen about 1250 A.D., in his account of eastern medicinal plants (*Grösse Zusammenstellung über die Kräfte der bekannten einfachen Heil*—and *Narungsmittel von Abu Mohamed Abdulla ben Ahmed aus Malaga, bekannt unter den namen Ebn Baithar*, . . . übersetzt von Dr. Joseph v. Sontheimer, 1842, page 138) records of sandal: '. . . this name betokens a wood which is brought from China.'

Barbosa (*The Coasts of East Africa and Malabar.* Hakluyt Soc., vol. 35), writing in or about 1500 A.D., mentions the uses of sandalwood in India. He asserts its occurrence in Timor but in no other locality, nor does he include it in the products exported from Cochin or Calicut. His evidence is of special value for (as pointed out to me by Mr. W. H. Moreland) he served chiefly on the Malabar Coast, was employed in commerce and, moreover, his experience was gained before the Portuguese upset the previously existing conditions of Asiatic trade.

Magellan (*First Voyage Round the World* by Magellan. Hakluyt Soc., vol. 35 page 153) tells us in reference to Timor '. . . for white sandalwood only grows in this country.'

Finally I must direct attention to the officially published records of the East India Company. (*The English Factories in India.* 14 volumes covering the period 1618 to 1677.) In 1618, we find the agents writing to the East India Company (vol. for 1618-1621 page 53): 'They know not whether sandalwood grows in the Island of St. Lawrence [Madagascar], but it is in good request in Surat and the Dutch have sold some. . . . Kerridge and his colleagues have accordingly written to the Bantam factory for a supply.' In subsequent volumes, up to that for 1665-1677, there are frequent references to sandalwood, but only in connection with vessels captured on the high seas or as being procured from Bantam for sale; this shows that there was a considerable trade in the wood at that period. Never, however, is there any record of the wood being obtained in India though there is much concerning traffic along the West Coast of India and also mention of trade with Seringapatam in the later years.

Discussion.

We have seen that the occurrence of *Santalum album* as a naturally growing tree in India is supported by very dubious evidence. While Barbosa does not mention it as growing in India, Garcia da Orta positively stated that it did not. It is not mentioned in Rheede's *Hortus Malabaricus* (1678-1703). It was not exported from India by the East India Company from 1618 to 1677, though it was much in use in India at the time and imported by them.

There is no possible doubt as to its being indigenous in Timor and in one or two of the neighbouring islands, whence it was exported from the earliest times. It was introduced from these islands into others in the same region, especially in the vicinity of old Indian temples. We have seen that it was also introduced, possibly on a very small scale, into India at the period of Akbar and that planted trees of sandal were seen by Garcia da Orta about the year 1550.

Those who maintain an Indian origin are faced with the extraordinary distribution of the species: in Timor and some of the neighbouring islands and in South India with none between, a gap of nearly 3,000 miles and still further between the latter locality and the habitat of any other species of the genus (see *Kew Bulletin*, 1937, page 193). It may be put forward that *Santalum album* did once occur in between the present habitats or, on the other hand, that the artificial introduction was actually in the reverse direction, but there is no evidence in support of either theory.

Further, if this tree has been growing in South India since its evolution, why was it confined, until the second half of the 19th Century, to so small an area and then spread so much wider during the present Century? Rao Sahib S. Rangaswami (*Indian Forester*, 1937, page 527) writes that in 1869 Col. Campbell Walker, Conservator of Forests, estimated the area occupied by sandal in the North Salem District at 8540 acres, whereas in 1937 it had spread to over 93,000 acres in the same District. Of recent years there have been many more or less successful efforts towards the same end by artificial means and there has also been much expansion by natural means, that is through the agency of birds. I may cite the case of the Palmaner Plateau. In about 1900, according to the inspection notes of a very capable and experienced Forest Officer (the late Mr. C. E. Brasier), sandal was confined to a few small plantations started in 1876; by 1921 the tree was abundant in the forests around (see *Kew Bulletin,* 1927, page 200).

I, therefore, put forward the theory that at a very early period a scented wood (or woods) was produced by a tree growing in India, probably mainly in the South. This wood was used for various purposes and went by the name of *Chandan.* Later on the wood of *Santalum album* began to be imported and as it became more and more available gradually replaced the indigenous wood. At first it may have shared the same name and in due course supplanted the original even in that respect. Eventually some enlightened person thought of introducing the plant itself, but the spread, except where enforced, would be slow. The fact that the tree where it grows at present appears to be indigenous need not impress one greatly when one considers the estabslishment of other non-indigenous plants in India. Who seeing lantana or prickly-pear-infested localities would imagine that they are aliens were the history of their introduction not known? I must now leave the decision to my readers.

In conclusion I wish to express my thanks to the following helpers: Mr. W. S. Millard, who obtained the kind offices of Mr. F. E. Bharucha to whom I am indebted for certain useful items and for extracts from Sanskrit literature furnished by Sir C. P. Ramaswamy Aiyar, the Dewan of Travancore; Mr. I. H. Burkill for advice and suggestions; Dr. D. Hooper, who referred me to the *Ain-i-Akbari,* which he had himself quoted a good many years ago in a paper on the 'Perfumes of the Moghuls'; Mr. K. Jacob for valuable information; Mr. G. P. Mazumdar for information through Dr. K. P. Biswas; Dr. R. Mookerji of the University of Lucknow; Mr. W. H. Moreland, who also referred me to the *Ain-i-Akbari* and gave me further most useful information; Dr. H. N. Randle at the India Office Library, who, besides kindly translating passages from Sanskrit works, afforded me other valuable citations; Dr. van Steenis of the Buitenzorg Herbarium who has taken great pains to obtain for me much information connected with the Dutch East Indies; and to Dr. E. H. Warmington, author of 'The Commerce between the Roman Empire and India.'

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BIRDS OBSERVED IN AND NEAR TAMBARAM, CHINGLEPUT DISTRICT, SOUTH INDIA.

(December 1932 to April 1938).

BY

ALICE M. BARNES.

Tambaram lies 16 miles south-west of Madras city, about 9 miles inland, at an average elevation of 100 ft. The surrounding country is very largely uncultivated scrub jungle with several groups of low rocky hills, the highest of which rise only to 600 ft. Round the foot of the hills the scrub becomes much thicker and forms dense thickets of small trees and thorny shrubs, wothia, dalbergia, albizzia and neem being some of the commonest trees. These hills and the elevated land round them form the catchment areas for several large tanks, from which rice fields are irrigated. There is very little other cultivation.

Four hundred acres of this scrub jungle were acquired and enclosed in 1930 for the new site of the Madras Christian College, and since October 1932 we—my husband and I—have lived on this estate, with the exception of April to December 1936 when we were on leave. The following notes are based on observations made during the periods October 1932 to April 1936, and January 1937 to April 1938; they refer to birds seen either on the college compound or in the immediate neighbourhood. The records are necessarily incomplete as we do not shoot, and are therefore unable to identify some birds, or to determine the races of others with any certainty.

During the years 1931 to 1938 several acres of the college estate have been cleared of scrub for buildings and playing fields, and a very large number of trees have been planted, but considerably more than half the area is still untouched jungle. The whole estate has been declared a sanctuary for wild life, so that it still affords ample opportunity for careful bird observation, in spite of its greatly increased human population. As the trees grow, birds which haunt large trees are beginning to make their appearance, though at present only occasionally.

The scientific names given in the list are taken from *Birds of Southern India* by Baker and Inglis and the notes on the Vernay Ornithological Survey of the Eastern Ghats published in the Bombay Natural History Society's *Journal.*

LIST OF BIRDS.

1. **The Jungle Crow** : *Corvus macrorynchos culminatus* Sykes.

Observed throughout the year; in jungle and garden; common, but not so numerous as the House Crow.

2. **The Common Indian House Crow** : *Corvus splendens splendens* Vieillot.

Observed throughout the year; in jungle and garden. In the earlier part of the period of observation, there were few houses and therefore few crows in this neighbourhood; the crows have increased with the human population, and are now very common.

3. **The White-headed Babbler**: *Turdoides striatus polioplocamus* Ober.

Observed throughout the year; very common, in jungle and garden. The heads of many are conspicuously white.

A nest with 3 eggs was found in a casuarina hedge in the garden in July 1934; two chicks were hatched, but stolen before they were fully fledged.

Two very young fledglings were observed in a bush, being fed by their parents, on September 3rd, 1937.

4. **The Common Babbler**: *Argya caudata caudata* Dumont.

Observed throughout the year; very common. Flocks are mainly seen in the scrub jungle, and very seldom come into the garden, though their pretty tinkling song is frequently heard in the bushes just beyond the garden limits.

5. **The Indian Yellow-eyed Babbler**: *Pyctorhis sinensis sinensis* Gmel.

Throughout the year; very common; in garden and jungle; nearly always seen in pairs.

6. **The Common Iora**: *Aegithina tiphia humei* Stuart Baker.

Throughout the year; very common; in garden and jungle.

7. **The Red-vented Bulbul**: *Molpastes cafer cafer* Linn.

Throughout the year; one of the commonest birds in this neighbourhood, large numbers always about in jungle and garden.

Nests and eggs have been found as follows:—

January 1933—nest finished but not used.
February 1938—3 eggs.
August 1934—1 egg.
November 1937—3 eggs.
December 1932—three nests: (*a*) 3 eggs, (*b*) 2 eggs, (*c*) 3 eggs.

These nests have all been identified by the presence of the parent birds; a good many other bulbul nests have been found but as they were not in use, have not been recorded.

In some cases the time of incubation could be observed, e.g. (*a*) November 11th, 1937—1 egg in nest, 12th—2 eggs, 13th— 3 eggs; November 25th—2 newly hatched chicks and 1 egg in this nest. (*b*) February 13th, 1938—1 egg in nest, 14th—2 eggs, 15th—2 eggs at 7-30 a.m., but 3 eggs at 5 p.m. February 25th—three newly hatched chicks in this nest.

These observations were made about seven o'clock each morning.

The November 1937 nest was built, and the family reared, during the N.-E. monsoon rains. Three of the above nests were built about 6 ft. from the ground in forks near the ends of branches in a bauhinia tree close to our house; others have been at about the same height in young wothia trees in the garden or jungle, and one in a casuarina hedge. The foundations of all the nests seem to have been of cobwebs.

8. **The Southern Red-whiskered Bulbul**: *Otocompsa jocosa emeria* Linn.

Throughout the year. This is as common as the Red-vented Bulbul, and seems to be one of the most numerous birds in this neighbourhood. It is always about both garden and scrub jungle, and also in the thicker jungle near and on the neighbouring hills.

There is no doubt about its race, as it conforms exactly to the description of *emeria* given by Whistler; the tail is tipped with white.

Nests have been found as follows:—

August 1934—2 eggs. Nest in a bush in the garden. These eggs were both stolen and sucked, presumably by a rat.

March 1938—this nest was placed too high for its contents to be seen; it was at least 12 ft. up in a bauhinia tree in the garden. Parents were observed bringing food to the nest.

9. **White-browed Bulbul**: *Pycnonotus luteolus luteolus* Linn.

Throughout the year. It is very common in both jungle and garden, but less frequently seen, and perhaps less numerous, than the two preceding bulbuls.

10. **The Pied Bush-Chat :** *Saxicola caprata.*

Observed throughout the year. Not very numerous, but as each pair seems to have definite 'territory', they can almost always be found in certain spots of garden and jungle.

11. **The Black Redstart :** *Phoenicurus ochrurus.*

Observed at Tambaram only in January and February 1936, when it frequented uninhabited buildings on the college compound and could be seen almost any day for nearly two months.

A Redstart was observed at Tada, about 40 miles due north of Madras on January 29th, 1938.

12. **The Black-backed Indian Robin :** *Saxicoloides fulicata* Linn.

Throughout the year; one of our commonest birds in jungle and garden.

Nests have been found as follows:—

April 1933, a nest being built in a rain gutter; eggs not seen.

August 1933, a nest being built in more or less the same spot in the rain gutter.

June 1934, another nest in the gutter.

June 1935, a nest being built in another gutter.

August 1935, a nest being built in an empty, broken flower-pot in the garden; this was disturbed by the gardener just as the nest was finished, and it was therefore deserted.

March 1937; on the 21st we first noticed the nest being built; both birds help with the work. On the 31st we found two eggs in the nest. The nest was abandoned before the eggs were hatched, probably because it had been disturbed by a gardener.

April 1937; a hen robin was discovered sitting on a nest in a dwarf date palm in the jungle; number of eggs not seen.

13. **The Indian Magpie Robin :** *Copsychus saularis saularis* Linn.

Has been observed in January, March, August and November, and is almost certainly resident in this neighbourhood, but as there are still no really large trees in the gardens or scrub jungle of the College compound, it only rarely visits us; more frequently it is seen in the forest and in big trees near villages a mile or two away.

14. **The Indian Brown Flycatcher :** *Alseonix latirostris.*

Observed once only, October 5th 1935, in bushes near the garden.

15. **The Blue-throated Flycatcher :** *Cyornis rubeculoides rubeculoides* Vigors.

Seen once only, on November 8th 1937, when a male spent a whole afternoon in a Persian Lilac tree just outside my window and in bushes close to the house, giving excellent opportunities for observation and identification.

16. **The Indian Paradise Flycatcher :** *Tchitrea paradisi* Linn.

Seen only on the following dates:—

December 23rd 1934, male in full white plumage and long white tail, in the Vandalur forest, about 2 miles S.-W. of the college estate at the foot of Vandalur hills.

July 6th 1935, female or immature male, in chestnut plumage, short tail, in Vandalur forest.

August 22nd 1935, female or immature male, in Vandalur forest.

January 14th 1936, chestnut bird, with long chestnut tail streaming behind as it flew, in Vandalur forest.

October 1937, a female or immature male spent about a week in and near this garden; the only time a Paradise Flycatcher has been seen on this estate.

March 23rd 1938, female or immature male in Vandalur forest.

April 19th 1938, female or immature male in another part of Vandalur forest.

17. **White-browed Fantail Flycatcher :** *Leucocirca aureola.*

Seen only in January 1938, when two spent about a fortnight in and near this garden. During this period they appeared punctually in the garden at seven o'clock each morning; their song could be heard approaching for five or ten minutes before they reached the trees near the house. They spent about half an hour in the garden and then moved on, and we did not see or hear them again till the next morning.

A White-browed Fantail Flycatcher was also seen on March 6th, 1936 in a mango orchard near St. Thomas' Mount, eight miles N.-E. of Tambaram.

18. **The Bay-backed Shrike**: *Lanius vittatus* Val.

Seen throughout the year, but is rare both in jungle and garden from April to August, and very common from September to the end of March. These birds seem to have hunting territory over which they assert a monopoly for weeks at a time, and no other shrike is allowed within the limits. They are tame little birds, and will let one approach quite near their perch before flying off to a little distance.

19. **The Rufous-backed Shrike**: *Lanius schach caniceps* Blyth.

Observed throughout the year, in jungle and garden. Very common. Like the Bay-backed shrike, this bird also seems to monopolise definite hunting grounds and to stay in that territory for weeks together. One which thus haunts the rather jungly garden behind our house is frequently seen singing a not unmelodious twittering song, very different from its usual raucous screech.

20. **The Indian Common Wood-shrike**: *Tephrodornis pondicerianus* Gmel.

Observed in the months of January, February, March, April, September and November; occasional visitor to the garden trees. Also seen in Vandalur forest, but not observed in the scrub-jungle of the college compound.

21. **The Little Minivet**: *Pericrocotus peregrinus* (Linn.).

Never seen in the garden or scrub jungle, but small flocks observed in fig and other big trees in Vandalur forest in March 1934, December 1935. November 1937, and one pair seen at Chembarambakkam Lake about six miles N.-W. of Tambaram on March 17th, 1938.

22. **The Black-headed Cuckoo-Shrike**: *Lalage sykesi* Strickland.

Seen only on the following dates:—

October 15th, 1934—a female, on a tree in the garden close to the house.

March 15th, 1936—male in Vandalur forest.

March 17th, 1938—male and female in big trees on the bund of Chembarambakkam Lake, about six miles N.-W. of Tambaram.

23. **The Ashy Swallow-Shrike**: *Artamus fuscus* Vieil.

Small flocks seen on the following dates:—

September 10th, 1933; August 24th, 1934; January 12th, 1936; September 5th, 1937. Those observed on August 24th, 1934 were sitting on the branch of a tall dead tree in Vandalur forest; all the others were on the leaf stalks of palmyra trees, or flying about in the vicinity of palmyras, on tank bunds a mile or two south of the college estate.

24. **The Black Drongo**: *Dicrurus macrocercus peninsularis* Ticehurst.

Seen throughout the year, very common, in garden and jungle.

25. **The Indian Tailor-bird**: *Orthotomus sutorius guzurata* Latham.

Throughout the year; very common in garden and nursery; not observed in the scrub jungle.

Nests seen as follows:—

July 1933—made of leaves of a *Saraca* seedling in the nursery—two chicks in nest, very young.

August 1934—made of one large *Bauhinia* leaf folded, in garden—three eggs.

November 1933—made of two *Bauhinia* leaves, in garden, two chicks, very young.

June 1935—nest made but deserted before use.

26. **The Ashy Wren-Warbler** : *Prinia socialis* Sykes.

I have not yet learnt to distinguish this species from the next satisfactorily, but either this, or the Indian Wren-Warbler, or both, are constantly about both garden and jungle.

27. **The Indian Wren-Warbler** : *Prinia inornata* Sykes.

A nest and four eggs which corresponded exactly to the description of the nest and eggs of this bird given in *Birds of Southern India*, were found in a big clump of tall grass in the scrub jungle on September 27th, 1934. On September 30th the nest was deserted and empty. The bird itself was not seen.

28. **Warbler ?** *Prinia sylvatica* Jerdon?

A largish bird of warbler build is a permanent resident of the scrub jungle ; it is brownish above and ashy to white below ; its distinctive habit is sitting on the topmost twig of high bushes in the scrub and shouting lustily.

29. **The Indian Oriole** : *Oriolus oriolus kundoo* Sykes.

Seen once only in Vandalur forest, October 1933. In Madras city it is common, but is very rarely seen or heard in this neighbourhood.

30. **The Brahminy** or **Black-headed Myna** : *Temenuchus pagodarum* Gmel.

From September to early April this bird is very common in this neighbourhood, larger or small flocks being constantly about garden and jungle, but by the middle of April the flocks have disappeared, though an occasional bird may be seen for another week or two. They generally begin to return in August ; dates on which birds have been noticed are as follows :—

August 12th, 1933—one bird ; August 21st, 1934—one bird, August 19th, 1935—two birds ; July 30th, 1937—two birds. Their return is always by ones and twos ; the earliest flock seen was on August 26th 1933, but generally no flock is observed until well into September. From September till the end of March these birds roost every night in large bushes or small trees in the scrub jungle, the same bush or tree being occupied quite regularly. The birds settle down early—about 6 o'clock—but are very easily disturbed ; we have frequently seen hundreds fly from one bush when we approached too near.

31. **The Common Myna** : *Acridotheres tristis tristis* Linn.

Throughout the year, in garden and jungle. It seems to have increased in numbers with the increase of population on this estate. Nests and young were observed in August 1937 in crevices in the roofs of a College hostel and the cricket pavilion.

32. **Baya** or **Weaver Bird** : *Ploceus philippinus* (Linn.).

A colony of nests was seen in trees near rice fields at Futtur, about 3 miles east of Tambaram, but no birds were observed.

33. **The White-throated Munia** : *Uroloncha malabarica* Linn.

Observed frequently in small flocks in jungle and garden in July, August, September, October and November 1933 and 1934, but not noticed here since then. On August 5th 1933 and August 30th 1934 munias were observed collecting fine dry grass, presumably for nesting, but the nests could not be located in the thick and thorny scrub.

34. **The Yellow-throated Sparrow** : *Gymnorhis xanthocollis* Burton.

Appears to be a winter visitor to this neighbourhood ; has been observed frequently in the garden in February and March 1934, March 1935 and January and February 1938 ; there seemed to be only one pair at a time.

35. **The Indian House Sparrow** : *Passer domesticus indicus* Jardine and Selby.

Throughout the year ; very common, and increasing in numbers as the number of houses on the college compound increases.

36. **The Red-rumped Swallow**: *Hirundo daurica erythropygia* Sykes.

Throughout the year; first observed and identified in November 1935; plentiful in jungle and about the houses on this estate. Nests observed as follows:—

August 25th, 1935; a partially constructed nest found under a small concrete bridge; on August 29th the nest was complete, the long entrance tunnel having been added, but heavy rains on September 3rd flooded the water course below the bridge, and destroyed the nest.

December 1936—a nest under the bridge in the same spot as the 1935 nest. Swallows flew out when we approached.

June 1937—swallows made a nest on the verandah of one of the staff houses; the nest was destroyed by the occupant of the house, but the swallows built it again immediately and were allowed to remain. They are said to have reared two babies in this nest during July and August.

July 1937—another nest in the same site under the bridge; on September 5th we found a nestling on the ground below the nest; it could not fly; we put it in the entrance tunnel and it crawled at once into the nest.

October 1937—a nest under construction in another arch of the bridge. Rains in early November washed away both the nests under the bridge.

January 1938—a newly constructed nest on the old site under the bridge; swallows flew out of it, but no young were observed.

37. **The Large Pied Wagtail**: *Motacilla maderaspatensis* Gmel.

Throughout the year; very common in jungle and about the buildings. This wagtail frequently collects in large flocks and perches on roofs, twittering and singing.

38. **Bush Lark?** *Ammomanes phœnicura* (Franklin).

Throughout the year, very common, in large flocks in open grassy patches in the scrub jungle and along the unfrequented roads of the college estate.

There is also a lark which appears to be a solitary bird, and spends much of its time in the garden flying up about 20 ft. and then parachuting down with a shrill whistling cry.

I find it very difficult to identify these larks with any certainty. [?*Mirafra affinis* cf. Jerdon *B. of I.*, ii, 418. 'It frequently perches on shrubs and even trees and takes short flights in the air, descending again with outspread wings . . . it has a pleasant little song which it utters during its short flights.'—Ed.]

39. **The Ashy-crowned Finch-lark**: *Eremopterix grisea grisea* Scopoli.

Throughout the year; very plentiful in the jungle, and on the grassy tank beds just beyond the college land. These little birds seem to spend the day on the tank beds and other open spaces but very large numbers come every evening to roost in little saucer-like depressions which they make in the unfrequented sandy or gravelly roads of the college estate.

40. **Loten's Sunbird**: *Cynnyris lotenia* Linn.

Observed in thick scrub jungle on a hillside about 5 miles south of Tambaram in December 1932. A pair frequented our garden for a fortnight or more in October 1937, but this is the only time that this sunbird has been noticed in this neighbourhood.

41. **The Indian Purple Sunbird**: *Cynnyris asiatica asiatica* Latham.

Observed in almost every month of the year, in the garden and jungle. There is generally at least one pair frequenting the hibiscus and other flowering bushes, but occasionally they disappear for a time.

42. **The Purple-rumped Sunbird**: *Cynnyris zeylonica* Linn.

Throughout the year; always about the garden and jungle. In the jungle they seem to have special affection for *Helicteres isora* and *Rivea hypocrateriformis*.

Sunbirds' nests have been found as follows:—

March 1934—a hen was observed taking food to the nest.

This was believed to be a purple sunbird, but as the male was not seen it is not possible to be certain.

February 1938—believed to be a purple-rumped sunbird's nest, but only the female was seen. One egg.

March 1938—a nest too high to be examined; it was a new nest, and the outside had been more or less covered with the papery winged fruits of *Tecoma*.

43. **The Pitta** : *Pitta brachyura* Linn.

Observed in garden and adjacent scrub jungle in February, March and April 1937, but not again till October 1937. Since October pittas have been resident in the bushes near our garden. Their regular habits are interesting; for example, for nearly two months—January and February—one appeared on the grass behind our house every morning about 6-30, coming always from the same direction, staying about five minutes and then going off in the opposite direction. Twice we saw it take a bath in the small sunken bird bath en route. Pittas still about in garden and jungle in April 1938, but not so vocal as in the colder weather, nor so frequently seen in the early mornings and late evenings as before.

44. **The Southern Golden-backed Woodpecker** : *Brachypternus benghalensis.*

As there were no big trees on this estate, no woodpeckers came here until June 1937, by which time a few trees had grown to a fair size. One woodpecker was observed in the garden three times in June, July and August 1937, but has not been seen here again since then. They are occasionally observed or heard in Vandalur forest.

45. **The Coppersmith** or **Crimson-breasted Barbet** : *Xantholaema haemocephala indica* Latham.

Owing to the absence of really big trees the Coppersmith is not resident on the College estate, but occasional birds have been seen and heard here lately —i.e. in February 1937, July 1937, October and November 1937. They have, however, been observed throughout the year in the big trees of the trunk road which runs through Tambaram, and in Vandalur forest.

46. **The Pied Crested Cuckoo** : *Clamator jacobinus jacobinus* Bodd.

Throughout the year; quite common in the scrub jungle and occasionally seen in the garden.

47. **The Small Green-billed Malkoha** : *Rhopodytes viridirostris* Jerdon.

Has been noted in January, February, March, April and July to December, but is probably a permanent resident of the scrub jungle. Appears occasionally in the garden; by no means uncommon; also frequently observed in Vandalur forest.

48. **The Southern Crow-Pheasant** : *Centropus sinensis parroti* Streseman.

Not in the scrub jungle or garden, but seen occasionally and heard more frequently, in Vandalur forest, at all times of the year.

49. **The Rose-ringed Paroquet** : *Psittacula krameri manillensis* Bechst.

Occasionally flies over garden and jungle, but has not yet been observed to settle in any of our trees.

50. **The Southern Indian Roller** : *Coracias benghalensis indica* Linn.

Throughout the year; very common in garden and jungle, and particularly fond of the chimney and roofs of the College Science Block.

51. **The Common Indian Bee-eater** : *Merops orientalis orientalis* Lath.

Throughout the year; very common, but somewhat erratic. At times there are dozens constantly about the garden for weeks, and then they seem to move on. This does not seem a seasonal and local migration: at any rate no definite rhythm or routine has yet been noted.

52. **The Blue-tailed Bee-eater** : *Merops superciliosus javanicus* Horsf.

Has been observed about here in all months between July and April. The note about the erratic appearances of the little green Bee-eater applies equally to this one also. At times, for two or three weeks a large flock will be constantly about the garden and adjoining scrub jungle, and then for a while no bee-eaters will be seen.

Two very young birds were about the garden in July and early August 1933.

53. **The Indian Pied Kingfisher** : *Ceryle rudis leucomelanura* Reich.

Two of these birds haunted a big well in the garden for about a month, December 1932 to January 1933. Pied kingfishers were often observed about the garden in 1933 and 1934; since then none have been noted here, but they are frequently seen near irrigation tanks in the neighbourhood in all months.

54. **The Common Ceylon Kingfisher** : *Alcedo atthis* subsp.?

Throughout the year; less common on the estate than in 1933 and 1934, but frequently observed on the irrigation tanks in the neighbourhood.

55. **The White-breasted Kingfisher** : *Halcyon smyrnensis smyrnensis* Linn.

Throughout the year; very common in the garden. Nesting in the earthen walls of a big unused well in the garden in March 1938; two young ones were flying about the garden with their parents in April 1938.

56. **The Hoopoe**. *Upupa epops* Linn.

Probably resident in the neighbourhood, but only an occasional visitor to the college compound; observed here only in November 1933, July, August, October 1935, January 1936, March and August 1937 and February 1938. Seen more frequently in Vandalur forest and on roofs in Tambaram village.

57. **The Bengal Palm-Swift** : *Cypsiurus parvus* subsp.?

Throughout the year; very common about the scattered palmyra trees on the estate, and wherever there are palmyras in the neighbourhood—e.g. on the outskirts of Vandalur forest.

58. **The Common Indian Swift** : *Micropus affinis* (Gray).

Observed only once, on August 8th 1937, about some rocky hills 2 miles north of Tambaram. When the hills were revisited in February 1938 the swifts had disappeared.

59. **The Little Indian Nightjar** : *Caprimulgus asiaticus asiaticus* Latham.

Throughout the year; very common in garden and jungle.

July 11th, 1937 a nightjar discovered sitting; one egg; on stony ground on a hillside in the jungle. August 1st nestling nearly fully fledged; August 5th, young bird flying.

60. **The Indian Great Horned Owl** : *Bubo bubo bengalensis* (Franklin).

What we believe to be this bird was sitting on the ridge of our house roof, hooting, late in the evenings of November 17th and 19th, 1934. It was clearly seen in the bright moonlight.

January 27th, 1935, a horned owl was disturbed by us from the nest, on the top of a low rocky hill about 4 miles east of Tambaram; two eggs in the nest. The nest was a mere depression in the ground.

61. **The Southern Spotted Owlet** : *Athene brama* (Temminck).

Probably common in this neighbourhood, but still appears only occasionally on the college estate. Observed once in November 1934, for several evenings in succession in August 1935, and similarly in January 1936. Not observed near the house again till April 1938.

62. **The Black or Pondicherry Vulture** : *Sarcogyps calvus* Scopoli.

Throughout the year; for the five years during which observations have been made, several of these vultures have frequented a group of palmyras at the uninhabited end of the college estate. They are also frequently seen over the Vandalur forest.

63. **The White-backed Vulture :** *Pseudogyps bengalensis* Gmel.

Probably permanently resident in the neighbourhood, but has only been noticed within the last year. On February 9th, eight of these vultures were found roosting on one palmyra tree and six on a neighbouring one in jungle about two miles north of Tambaram.

64. **The Smaller White Scavenger Vulture :** *Neophron percnopterus ginginianus* Latham.

Throughout the year, but not common in the immediate neighbourhood, probably owing to the attraction of large tanneries about five miles north of Tambaram, where they congregate in large numbers.

65. **The Kestrel :** *Falco tinnunculus.*

Observed twice only, March 17th, 1934 and March 10th, 1938. Each time the bird was seen on the grassy maidan of an irrigation tank, and allowed us to approach quite near and observe it for a considerable time with the field-glasses. Wren disturbed it flew a short distance and settled again on the ground or on a low rock. Both birds were definitely kestrels, but the race could not be determined.

66. **The Common Pariah Kite :** *Milvus migrans govinda* Sykes.

Throughout the year ; very common over garden and jungle.

67. **The Brahminy Kite :** *Haliastur indus indus* Bodd.

Throughout the year ; very common over garden and jungle.

68. **The Black-winged Kite :** *Elanus caeruleus.*

Observed once only, on October 27th, 1935. This bird, answering exactly to the description given in *Birds of Southern India*, was sitting on top of an electric installation pole in the compound ; we watched each other for a considerable time.

69. **The Pale Harrier :** *Circus macrourus* Gmel.

Observed frequently over jungle and garden in all months October to March inclusive, every year since 1932.

First and last dates on which it has been seen each season are as follows :—

1933-34. First seen on October 23—Last seen on March 17th.
1934-35. First seen on November 2nd—Last seen on March 19th.
1935-36. First seen on October 19th—Last seen on March 26th.
1937-38. First seen on November 6th—Last seen on March 30th.

These dates apply only to the male bird, as I have not yet learnt to distinguish the female Pale Harrier from the females of other species of harriers ; females have been noted earlier and later than males each year.

70. **The Pied Harrier :** *Circus melanoleucas* Pennant.

Observed in January, February and March of the years 1934, 1935, 1936, 1937, over stubble fields south of the college ; never observed over the scrub jungle of the college estate. This note refers to the male.

71. **The Marsh Harrier :** *Circus aeruginosus aeruginosus* Linn.

Observed over wet rice fields in this neighbourhood in February 1936 and January 1938 ; never seen over the jungle.

72. **The Indian Spotted Dove :** *Streptopelia chinensis suratensis* Gmel.

Throughout the year. Numerous in garden and jungle.

73. **The Little Brown Dove :** *Streptopelia senegalensis cambayensis* Gmel.

Throughout the year ; very numerous in garden and jungle.

Two nests were found in thorny bushes in the scrub jungle in April 1938 ; both contained one white egg. They are believed to be nests of the spotted Dove, but the sitting bird flew off so quickly among the bushes, that it was difficult to be quite definite as to which species it was.

74. **The Grey Partridge** : *Francolinus pondicerianus* Gmel.

Throughout the year ; very numerous and very noisy in garden and jungle.

75. **The Little Ringed Plover** : *Charadrius dubius* Scop.

Observed on the moist shores of irrigation tanks in January and February and March each year ; fairly common.

76. **The Yellow-wattled Lapwing** : *Lobipluvia malabarica* Bodd.

Observed each year in January, February, March, April, August, September and October ; probably here all the year round. Very frequently seen on the college playing fields in the early mornings and late evenings ; very noisy on these fields on moonlight nights in February, March and April 1938.

77. **The Common Sandpiper** : *Tringa hypoleucos* Linn.

Observed in January, February and March each year on the edges of irrigation tanks in the neighbourhood. Very common.

78. **The Pond Heron** or **Paddy Bird** : *Ardeola grayii* Sykes.

Observed on the marshes and wet paddy fields two miles east of Tambaram in December, January, February, March and April. Very common.

79. **The Tufted Pochard** : *Nyroca fuligula fuligula* Linn.

Seen once. A large flock was riding the water of Chembarambakkam Lake, about six miles N.-W. of Tambaram, on February 28th, 1938. When the Lake was again visited on March 17th, these birds had entirely disappeared.

80. **The Grebe or Dabchick** : *Podiceps ruficollis* (Vroeg).

Seen in January and February 1938 on an unfrequented pond at Puttur, about two miles east of Tambaram.

PROTECTIVE ADAPTATION AMONG SOME INDIAN SPIDERS.

BY

T. V. SUBRAHMANYAM.

(With one photo and 3 text-figures).

Nature, a mother kind alike to all, has bestowed on every living being a special virtue by which it is enabled to thrive, to obtain its sustenance and to protect itself from its enemies. In some animals defence takes the form of extreme swiftness of movement, some have warning colours, some the power of mimicry, and others resort to one or the other of the hundreds of different devices and modifications. Innumerable examples of such adaptations are found in the insect world. Among spiders, which form the subject of this article, many interesting examples of protective adaptation are found. But as these creatures are generally looked upon with horror and repellance, few care to observe the instinct displayed by them. A study of the varied habits of spiders does in itself provide to the Naturalist an ample field which has been explored only imperfectly so far.

Though most of the familiar orders of spiders are represented abundantly in India, many Indian species still remain unidentified and even some of the orders are omitted altogether. To a certain extent this incomplete taxonomical study renders it difficult for the field naturalist to describe comprehensively the habits of all the spiders that he comes across during his collection work. However enthusiastic a collector may be, unless he familiarizes himself at least with the generic names of the specimens he secures, he cannot write a comprehensive and detailed account of their habits although he may know for himself that 'X' specimen behaves this way and 'Y' specimen in that. With regard to such Indian spiders as the Hersiliids, Attids, Thomisids and Theridiids the above difficulty is felt much as the literature concerning them is scarce.

Apart from the scientific classification, based on their habits Spiders can be grouped under the following heads:—

I.—SEDENTARY SPIDERS.

(Including Argyopids, Theridiids, Pholcids and Eresids).

II.—ROVING SPIDERS.

- (*a*) Hunting Spiders or Wolf Spiders (Lycosids).
- (*b*) Jumping Spiders (Attids).
- (*c*) Bark Spiders (Hersiliids).
- (*d*) Grass Spiders (Oxyopids).
- (*e*) Crab Spiders (Thomisids).

I.—SEDENTARY SPIDERS.

Sedentary spiders construct webs of their own and reside within.

Among the snare builders Argyopids are the most common and abundant in our gardens. They construct beautiful circular snares with geometrical precision. A careful study of an Argyopidean web reveals that almost always its foundation lines have direct connection with the leaves of the plant or tree by whose side the web is located. The slightest disturbance on any part of the web is telegraphically conducted by the radii to the central hub where the spider usually sits. If the source of disturbance is an enemy, the spider with electric speed rushes to the contiguous leaf and hides on the underside, failing which, it abruptly drops to the ground and disappears. On the other hand, if the shaking of the web is caused by the struggle of a captive insect, which has accidentally fallen on it, the spider at once approaches the prey along one of the radii, binds its legs and wings with a profuse flow of silk from the spinnerets and drags it to the centre. Sometimes at the sight of an enemy, the Argyopid purposely vibrates its web with such an astonishing speed that both spider and web are rendered invisible. In a way this swinging action enables the spider to secure its prey, for, if the glutinous threads happen to touch the insects flying near the web, they are instantaneously caught.

These methods of capturing their prey and concealing themselves from enemies are the characteristics of Argyopids in general. Besides these, special adaptations of both protective and aggressive significance are also found in some of the Argyopidean genera.

Its huge black body with deep yellow bands and its scarlet mandibles, make *Nephila maculata* such a formidable and grotesque creature that it is rightly called the Giant Wood Spider. If at all the common enemies of Araneids, like the birds and lizards, prey upon this series they would do so only with shuddering qualms. The orange bands on the body of the common Argyope and the white drawings on that of *Epeira diadema* must have also a protective significance. Another common species met with in our gardens, especially during the rainy season, is the *Tetragnatha*. Its small cylindrical body assists it to a great extent in concealing itself from its enemies. Approached by an enemy, it at once runs to hide itself on the underside of the nearest leaf by assuming a peculiar linear position (see figure). Some species of *Tetragnatha* are dull green in colour which serves as an additional protective advantage. *Leucauge*, a genus closely allied to *Tetragnatha*, behaves in a similar way. Some species of *Leucauge* found in India are light green in colour and successfully harmonize with the surrounding verdure. The common *Gastercantha* with its small dark rhomboid body and minute legs resembles a chip of wooden bark suspended in air. Epeirans often sit motionless in the axils of leaves folding their legs in such an artistic fashion that they appear at first sight to be lifeless objects. Some of them rest on branches of trees imitating patches of lichen growth, while other members (*Caerostris*) living on the bark of trees are easily mistaken for woody knots.

Theridiids agree to some extent in their general habits with the Argyopids. They also are good web builders; but their webs are made of irregular threads without any geometrical plan. They are common both in gardens and in corners of houses. They are mostly of small size and more secretive in habit than the Argyopids. When chased they instantaneously sham death, a device which to some extent enables them to escape attack.

Pholcids are represented abundantly in India. They are a tribe of harmless spiders, shy by nature, occupying safe and unfrequented localities such as the roofs and rafters of old houses, and never venturing to stir out of their irregular webs. Perhaps their long legs prevent them from falling a prey to their enemies. A pholcid caught by the legs generally escapes by shedding the limb or limbs.

Nest of Eresidian spider.

The common Indian Eresids, belonging to the genus *Stegodyphus*, are also sedentary spiders constructing a very complicated type of nest. A peculiarity with these creatures is that they are very social, a number of them forming a colony and living in a single nest. Such a social life is found nowhere else in the Araneid world. The architecture of the Eresidian web is entirely different from that of other spiders. It is saccular in appearance and consists of numerous chambers perceptible from outside in the form of small round apertures. The nests are usually found fixed to the extremities of the branches of trees and bushes or along fences (*vide* photograph). Sometimes, attached to the main nest is an extensive net whose threads are arranged irregularly in a vertical and horizontal fashion, not concentrically, as with Argyopids. Insects that fall into this net seldom escape from its highly viscid threads. The grey colour of the Eresidian web agrees with the colour of the spiders and it is only with some difficulty that they can be detected within their webs. At the sight of an enemy they retreat deep into the concavity of their nest which, due to its complicated structure, is impervious to the attack of birds and dragon flies. Again, the fibres of the nest being highly sticky, birds generally do not tamper with it.

II.—Roving Spiders.

The Roving Spiders are not sedentary but hunt in search of prey. Though generally not web builders like the sedentary tribes, some weave small patches of web during certain stages of their life. The females weave such webs for the protection of their cocoons during the breeding season. Again, during the moulting period they construct webs and remain sedentary till the critical phase is safely passed. Even during other periods many possess permanent abodes for retirement.

Of all the roving spiders perhaps the most cunning and powerful are the Lycosids. From their voracious habits and perseverance in making expeditions in search of prey they are called Wolf Spiders or Hunting Spiders. Examples of various modes of life are found within this group. Many of them build no snares, yet are vigorous hunters running zig-zag along the ground. Some like *Lycosa annandalei* are amphibious in habit. *Hippasa pantherina* is a species which constructs intricate webs and is mostly of sedentary habits.

Hippasa generally builds its abode in burrows in the ground, in natural crevices by the buttress roots of trees, or among the whorls of the suckers of the *Pandanus*. The webs are cylindrical and are often an inch in diameter. The tube runs into the ground vertically to a depth of about 9 inches and bends at an obtuse angle. The spider sits at the mouth of its web, a vigilant sentry, but at the sight of man or an enemy it immediately recedes to the bent portion of the tube. Pursued further, it rushes to the deepest recess and is completely out of sight.

One peculiarity with regard to the Lycosids in general is that when hunting they never move straight but go zig-zagging, stopping here and there in the manner of a fly. This deceptive resemblance to the movements of a fly is supposed to be both aggressive and protective.

Some Lycosids are capable of staying below water for more than 20 minutes. They live in small holes near water and evade their enemies by diving in. They creep down the stems of aquatic weeds and plants to hide, if chased further, they sham death, fold their limbs, drop into the water and float on the surface. They feed on aquatic flies, and some are said even to hunt small fishes.

Jumping Spiders come under the Order *Attideae*. Attids are ubiquitous and are found commonly on walls and in corners of houses, among plants, on tree trunks—everywhere. All of them are of moderate or small size, but they differ much in colour and habits. Mimicry of the most wonderful type is present in this group. They perform surprising acrobatic jumps to escape from their enemies.

Once, while passing along a foot-path near a fence, I was attracted by the infloresence of a plant. It appeared at first sight to consist of white and black flowers. On examnation, however, what appeared to be black flowers proved to be dead bees. The problem of how these dead bees came to be there puzzled me. I scrutinized every part of the plant and at last was able to find out. Hidden under the small flowers were three small Attid spiders, beautifully coloured with metallic blue and white stripes which, with their minute legs, resembled floral stamens. One of them was actually sucking a bee at the time. Hence there could be no doubt that the dead bees were the remains of the meals of these spiders. This illustrates how, not only Thomisids, but also Attids practise the same method of capturing prey, by hiding inside flowers. This kind of protective adaptation has a dual advantage: the spiders avoid the notice of their enemies and at the same time get their food ready at the door.

In the case of *Myrmarachne*, which is an Indian ant-mimic spider, 'the mimicry is so perfect that quite often it requires the second glance of even an experienced collector to distinguish one of these spiders from the ants amongst whom they are often seen moving about'. There is some controversy with regard to this ant-mimicry. Is it protective or aggressive? No doubt, ant-mimicry has its protective value, but does it necessarily follow that it has no aggressive value because the mimics do not feed on the models? In the false garb of an ant, the spider may feed on other minute insects which are not attacked by ants. By their shy nature and quick movements coupled with their mimicry, the ant-mimics successfully evade their enemies.

Attids, though termed vagabonds, and typical roving spiders, more often than not weave a small patch of membraneous canopy for retirement. During breeding time this patch is made thicker and more elaborate to protect the cocoons. Just like the Sparassids, some Attids bind the margins of one or two contiguous leaves and live within. Others hunt in the grass and imitate the life of an Oxyopid. On more than one occasion, I have seen Attids living within the cast-away shells of garden snails. Once on breaking open an old pupa of a butterfly I was surprised to find an Attid residing comfortably within, with its cocoon. A life similar to that of a Hermit-Crab. Was it after feeding upon the original inmate that the spider used this covering as its house, or was it after the emergence of the chrysalis that the spider met with the cast-away shell and converted it into a residence? If the former, it necessarily follows that the Attids also contribute to the destruction of Lepidopteran pupae. However so much is certain: among all the roving spiders, Attids seem to show the least discrimination in the selection of their residential quarters.

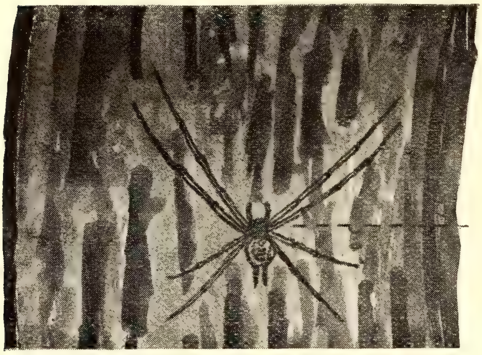


Fig 1.—A Hersiliid spider on tree bark.

Hersiliids also are vigorous hunting spiders. As a rule they inhabit small holes and crevices in the bark of trees. They are also found in plenty on old walls. The species that hunt on old, white, mortar walls are generally pale white, quite in uniformity with the colour of the wall; while the more common species that occupy the tree trunks are brownish black, harmonizing with the colour of the bark. Add to this colour adaptation their peculiar posture: with a flat body and long-spread-out legs they adhere so closely to the surface that it is not easy to detect their presence at first sight (vide fig. 1). When pursued, they crawl sideways and up the tree trunk in an ascending spiral, leaving the pursuer disappointed alike.

Oxyopids are small or moderate sized spiders found abundantly among grass and small vegetable growths. They are better jumpers than runners and their sharp spined legs may be of some protective value. The more common species found in India are either *Peucitia virdiana* or *Peucitia elegans.* The light green or dull yellow colour of the body and the black spines on their legs agree so harmoniously

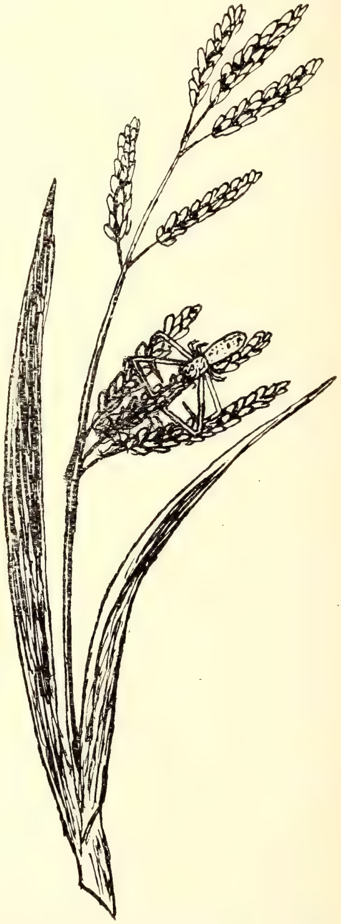


Fig. 2.—A Psechrid spider on grass.

with the surrounding ears and corns of the grass, that they are very safely hidden and difficult to detect. Remaining undetected by small insects the Oxyopid darts at and preys upon them. They have no webs of their own excepting in the breeding season when the female spins a small patch of silky web on the plant leaf to protect its cocoon. Oxyopids are common in rainy months when all sorts of vegetative growths spring up.

The *Psechrideae*, another Order easily distinguished by the prominence of the first two pairs of legs, spend their lives amongst grass blades, just like the Oxyopids (Fig. 2).

Next come the Thomisids. Their general shape and architecture resemble those of a miniature crab. Like crabs they move sideways and are hence called Crab Spiders. Thomisids are generally small in size and are mostly preyed upon by other spiders. Perhaps their lateral movements help them to escape from their enemies. I have seen an Attid spider pouncing on a Thomisid, but the former missed its prey as the latter escaped by a sideways somersault. Thomisids are often found resting inside flowers where their upward

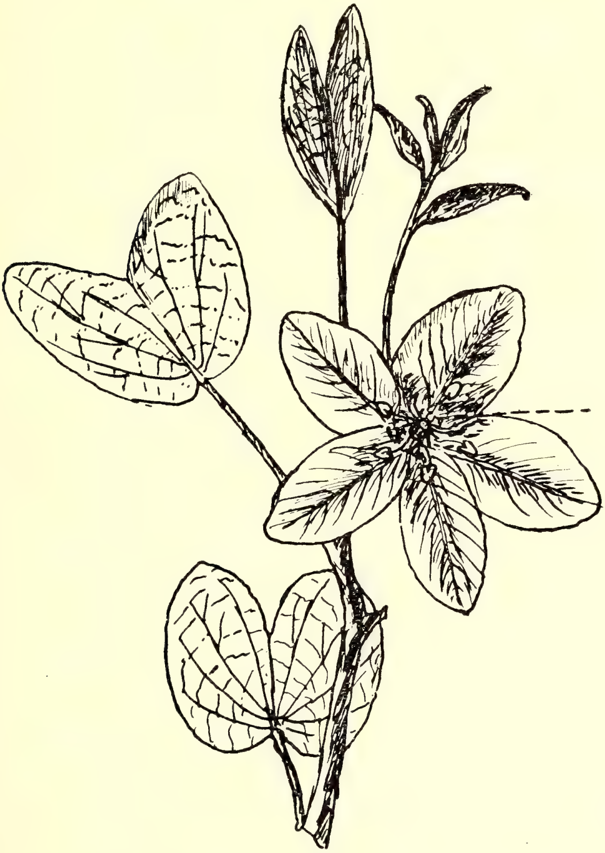


Fig.—3. A Thomisid spider in a Bauhinia flower.

thrust legs are easily mistaken for floral stamens (fig. 3). Flower visiting insects, like bees, become their easy prey. Thomisids inculde only a few species, compared with other groups, and even these few are but poorly worked out.

Clubionids are another group of hunting spiders. So also are the Sparassids. Both are found commonly in our gardens. *Olios tener,* a Clubionid rolls up leaves into a cylinder and resides within. By so doing it protects itself both from its enemies and from the sun and rain. *Palystes flavidus* is a Sparassid. It is green in colour and usually lives on the underside of leaves. Its colour is so near in tone to that of the leaf, that it is difficult to discover.

It will be observed from the foregoing that the colour scheme, mimcry and other adaptations—all have an important bearing upon the lives of spiders, since they enable them either to escape from their enemies or to secure their prey with less effort.

Who then are the enemies of spiders and what is their prey?

Of all the enemies of spiders, perhaps the most powerful are birds. Birds have a very keen vision and that peculiar habit of pecking at every small creature that comes within reach. Only after thorough experimental tasting do birds discriminate as to which spiders or insects are edible and which are not. Most spiders that are not protected either by warning colours or spiny coverings fall an easy prey to birds. Certain birds make judicious employment of spiders' silk in lining their nests.

House lizards like Geckos, often prey upon Pholcids and Theridiids, while Bloodsuckers (*Calotes*), skinks (*Mabuia*), and insectivorous mammals like shrews make a good meal of spiders inhabiting gardens.

Solitary and social wasps are the most vehement enemies of spiders. They persistently hunt them and store them up in their nests for the sustenance of their offspring.

Ants are also enemies of spiders; though the ant-mimic spiders are on friendly terms with them. The common red ants feed on the *Tetragnatha* and *Palystes.* The eggs of the Epeirans and other garden spiders are also sumptuously feasted upon by ants.

Spiders also should be regarded as the enemies of spiders. Cannibalism is a characteristic of this group.

I also know of a solitary instance of a Dragon-fly catching an Attid spider most probably for food.

As to food, spiders prey on almost all sorts of insects and other minute creatures. Web weaving spiders first bind their prey with silk, making it inert and powerless and then sucking out its juices. But vagabond and other webless spiders like Oxyopids, Lycosids, etc. seize their prey and feed on them direct. Aquatic flies and dragon flies and even small fishes constitute the food of water spiders.

There are numerous books on spiders written by ancient authors and although many of them are interesting, when dealing with the habits of spiders they display more of literary beauty than scientific fact.

McCook, in one of his works *American Spiders and their Spinning Work* (Philadelphia 1893), gives a splendid account of the habits of spiders. The habits of *Lycosa* and *Epeira* have been dealt with in a very exhaustive way in J. H. Fabre's *Life of Spiders.* The researches of two American Arachnologists, George and Elizabeth Peckham are published under the title of 'On Mental Powers of Spiders' in the *Journal of Morphology* (Boston, U.S.A.) 1887, p. 403. Spiders are included also in works of general nature like *Intelligence of Animals* and *Protective Colours of Animals* written by authors like Houssary, Poulton, and a host of others. So far as the Indian Spiders are concerned a comprehensive and comparative work on the habits of Spiders is still wanting.

In writing this article I have only taken into consideration the more common genera of the Indian Archnomorphic Spiders. There must be equally interesting instances among the Mygalomorphic Spiders as well. Closer study of the habits of spiders will disclose yet more interesting examples of protective adaptation. 'Believing firmly from the evidence afforded by the causes that all animals are coloured in such a way as to best secure their safety and other interests, and not so as to expose them to danger, I am sure that as we progress we have found in every instance part of the great Creator's wonderful plan to ensure the welfare of His creatures and at the same time add brightness and beauty to the world.'—(T. Carreras.)

THE INDIAN CADDIS FLIES (*TRICHOPTERA*).

BY

MARTIN E. MOSELY, F.R.E.S., F.Z.S.

(*With twelve plates*).

PART V.

(*Continued from page* 478 *of Volume* xxxviii, 1936).

SERICOSTOMATIDAE McLACHLAN.

Sericostomatidae.—McLach., Rev. & Syn. Trich., pp. 221-223, 1876.

CHARACTERS OF THE FAMILY.

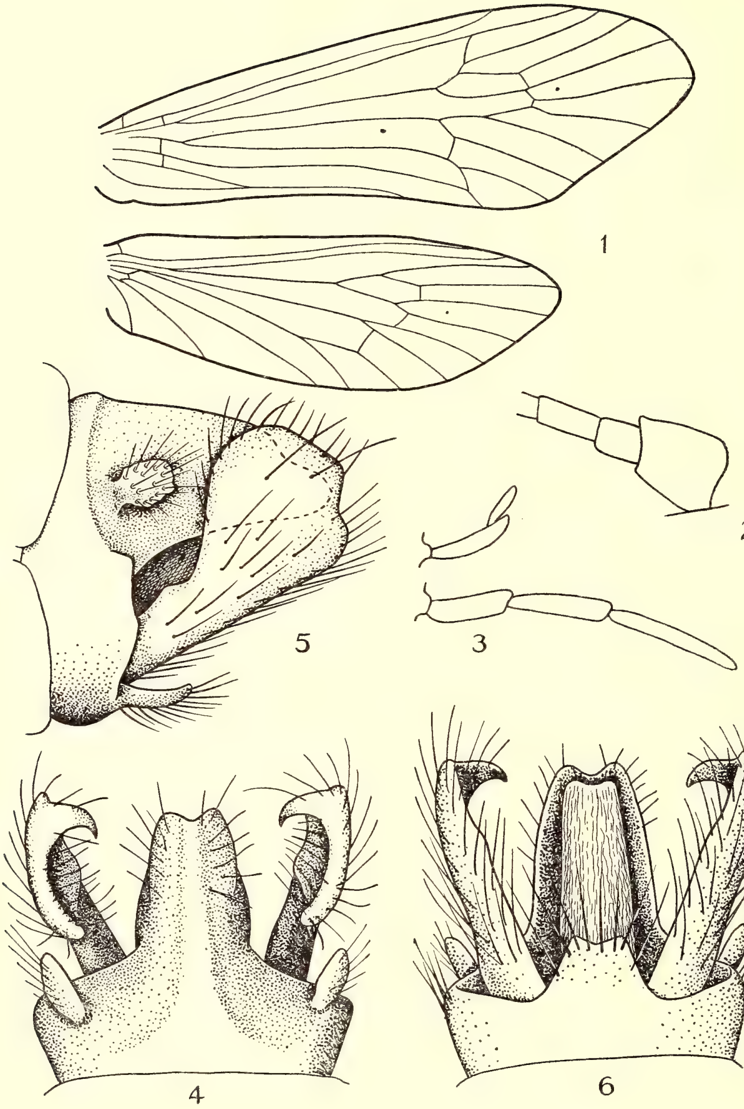
Antennae as long as the wings or slightly shorter; moderately stout, basal joint often much longer than the head; generally thickly clothed with hair; sometimes furnished with processes or spines; ocelli generally absent; present in the genus *Eothremma.* Maxillary palpi of the ♂ always different in form to those of the ♀, frequently membranous and clothed with specialised hairs or scales; they may be pressed against the face, or merely carried upturned; they are frequently, in this sex, associated with scent-diffusing apparatus; the number of joints varies from one to four but in the ♀, there are always the usual five; labial palpi alike in both sexes, the basal joint small, the second considerably larger, about the same length as the third: wings usually densely pubescent, often with scales or specialized hairs mingled with hairs of the ordinary form; frequently with scale-lined grooves and sometimes with folds as well, or folds without additional grooves; posterior wings generally without folds but frequently with grooves; neuration varying greatly according to genus, or even in the same genus, or between the sexes of the same species; neuration generally more regular in the ♀ than in the ♂.

KEY TO THE SUB-FAMILIES.

1. Ocelli present. THREMMINAE
—Ocelli absent. 2

2. Fork no. 4 in the posterior wing generally present. HELICOPSYCHINAE
—Fork no. 4 in the posterior wing always absent. 3

3. Spurs 2, 2, 4. SERICOSTOMATINAE
—Spurs other than 2, 2, 4. 4



Notidobia nigra sp. n., ♂.—Fig. 1, wings. Fig. 2, basal joints of the antenna. Fig. 3, palpi. Fig. 4, genitalia, dorsal. Fig. 5, lateral. Fig. 6, ventral.

4. Spurs 2, 2, 2 or 2, 3, 3. BRACHYCENTRINAE
—Spurs other than the above. 5

5. Fork nos. 1, 2, 3, 5 present in the posterior wing. GOËRINAE
—Fork nos. 1, 2, 3, 5 never all present in the posterior wing. LEPIDOSTOMATINAE

Genera not placed in sub-families.

Ashmera spurs 2, 4, 3. Discoidal cell in the posterior wing closed.

Noleca spurs 2, 2, 2, (maxillary palpi single-jointed).

Gastrocentrides spurs 1, 4, 4: forks nos. 1, 2, 3, 5 not all present in the posterior wing.

It has not been found practicable to give keys to the species in the Sericostomatid genera. The student must therefore have direct recourse to the descriptions and figures.

SERICOSTOMATINAE Ulmer.

Sericostomatinae Ulm., Abh. Natur. Ver. Hamb., 18, p. 78, 1903.

Head differently formed in the sexes; basal joint of the antenna shorter than the head; maxillary palpi pressed closely against the face, two- or three-jointed; wings elongate, densely pubescent, neuration alike in both sexes; apical forks nos. 1, 2, 3, and 5 present in the anterior wing, nos. 1, 2, and 5 in the posterior; discoidal cell closed in both wings, the anterior open or closed in the posterior wings. Spurs, 2, 2, 4.

Only one genus, *Notidobia*, has so far been found to occur in India.

Notidobia Stephens.

Notidobia Steph., Ill. Ent., p. 185, 1836.

Spurs 2, 2, 4.

Antennae stout with a stout, nearly rhomboidal basal joint; maxillary palpi pressed against the face, two-jointed in the single, known, Indian species; discoidal cell of the anterior wing oblong, the first apical sector connected with the radius by a nervule at or near the base; posterior wing, discoidal cell not connected to the radius by a transverse nervule. Other characters as detailed in the specific description.

Genotype: *Notidobia ciliaris* L.

Notidobia nigra sp. n. Pl. 1, Figs. 1-6.

Insect black. In the ♂, basal joint of the antenna stout, somewhat rhomboidal; maxillary palpi two-jointed, basal joint slightly curved and longer than the second; labial palpi with the first and second joints approximately equal in length, third rather longer; wings black, neuration conforming generally with that of the genotype, *ciliaris*, but differing in detail, Genitalia ♂.—Apical margin of the ninth tergite strongly produced at its centre to form a dorsal plate, apex excised; at the base of the plate, on each side, is a small, rounded process as seen from the side; penis large, covered by the pent sides of the dorsal plate; inferior appendages with greatly dilated apices slightly notched at the lower apical margin, a stout claw arising at the upper angle of the notch, directed inwards; centre of the margin of the ninth sternite produced in a small ventral plate with an excised apical margin.

Length of the anterior wing ♂ 9 mm.

N.-E. Burma: Kambaiti, 6,800 ft., 9-iv-1934; 7,000 ft., 10-iv-1934, R. Malaise.

Type ♂ in the collection of the Stockholm Museum. Paratype ♂ in the British Museum collection.

Goërinae Ulmer.

Goërinae Ulm., Abh. Natur. Ver. Hamb., 18, p. 81, 1903.

Ocelli absent; basal joint of the antennae about twice the length of the head, very hairy; maxillary palpi of the ♂ closely applied to the face, hairy, often with thickened or clavate hairs; joints varying in number, labial palpi long and stout; wings short and broad, densely pubescent, often with grooves or folds, especially in the posterior region in the ♂, that partly obliterate the neuration which, otherwise, is the same in both sexes; in the anterior wings, discoidal cell present, open in the posterior; apical forks nos. 1, 2, 3, and 5 in both wings; generally a ventral process to the sixth or seventh ventral segments, sometimes both.

In the ♀, the ninth dorsal segment is rather small and from it proceeds the tubular piece which is deeply divided, forming two narrow, hairy valves; ninth ventral segment nearly obsolete, eighth forming a polished plate, seventh regularly rounded; a tooth to the sixth. Spurs 2, 4, 4 or 1, 4, 4.

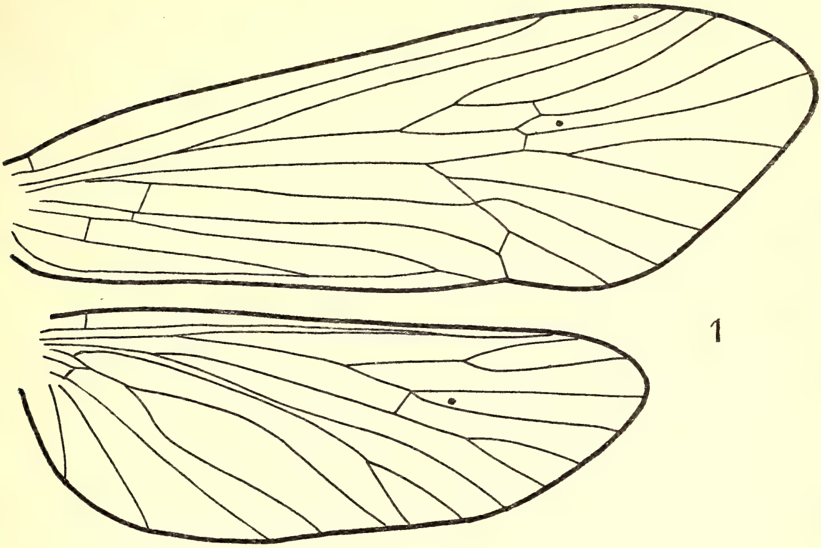
Goëra Leach.

Goëra Leach, Edinb. Enc., p. 136, 1815;
,, McLachlan, Rev. and Syn. Trich., p. 240, 1876;
,, Ulmer, Gen. Insect., fasc. 60a, p. 87, 1907.

Spurs 2, 4, 4 or 1, 4, 4.

Maxillary palpi, generally three-jointed, the two basal joints very short, terminal joint sometimes capable of being inflated in a membranous sac bearing specialized hairs or androconia; wings generally short and broad, covered with dense pubescence, but there are no intermingled scales; neither folds nor grooves in the male wings; in the anterior wings in both sexes, the area below the *cellula thyridii* is generally dilated at the end, forming a small, irregular, circular space free from pubescence; external post-costal cellule in the anterior wing, very long and narrow; a transvervse nervure connecting the lower branch of the sector to the upper branch of the medius in the posterior wing; spurs 1, 4, 4 or 2, 4, 4.

Genotype: *Goëra pilosa* F.



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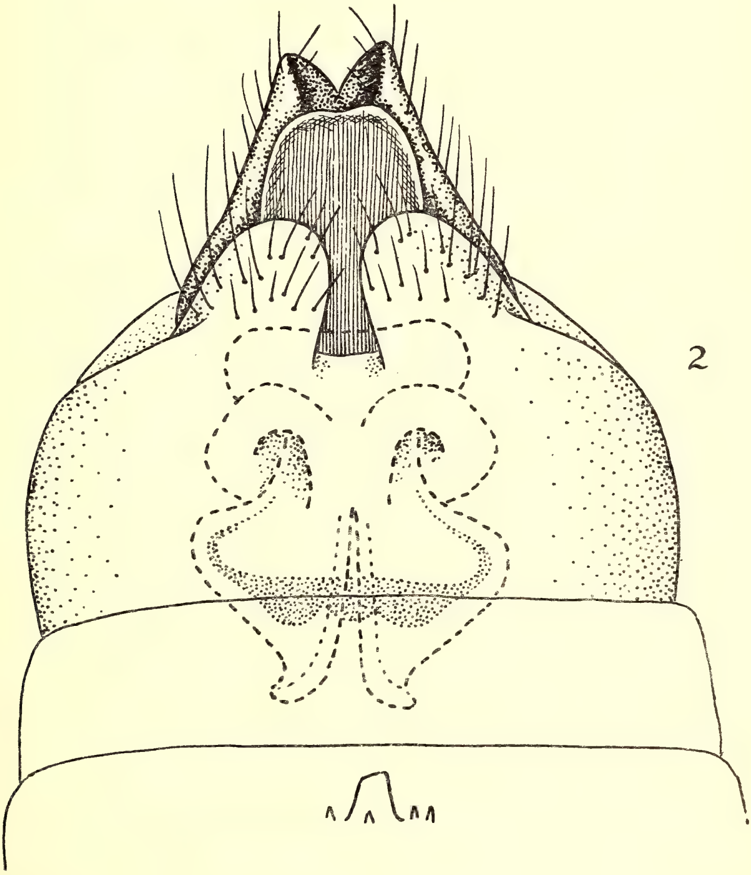
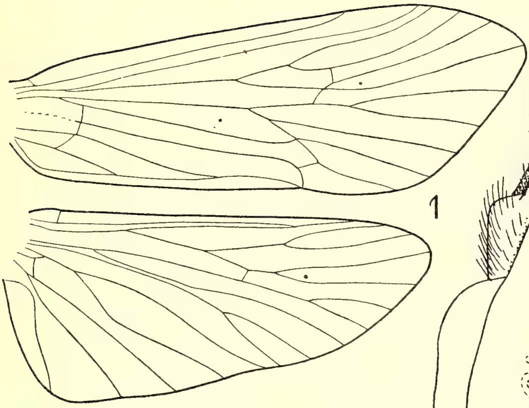


2

Goëra atra sp. n., ♀.—Fig. 1, wings. Fig. 2, apex of the abdomen, ventral.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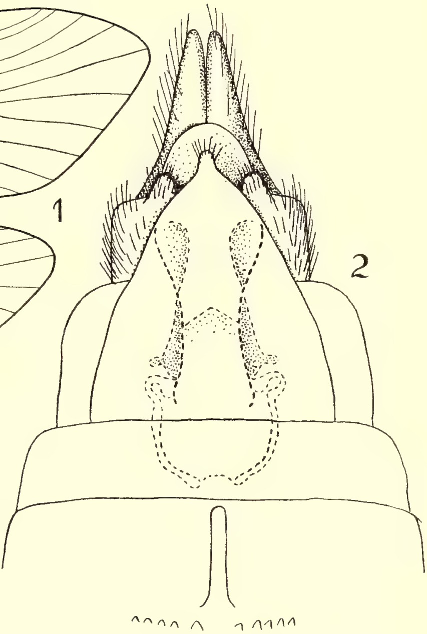
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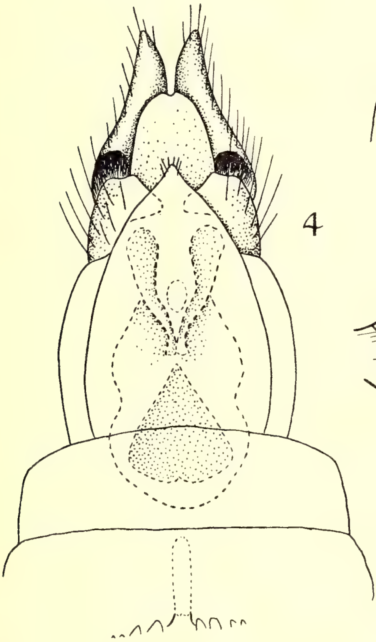
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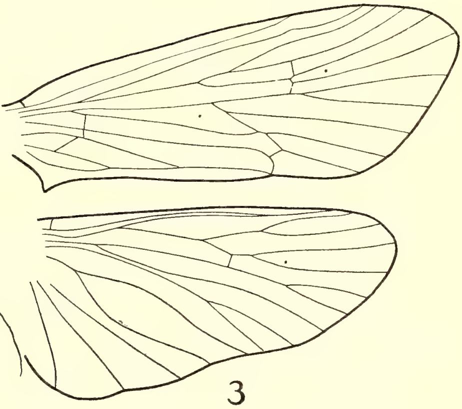
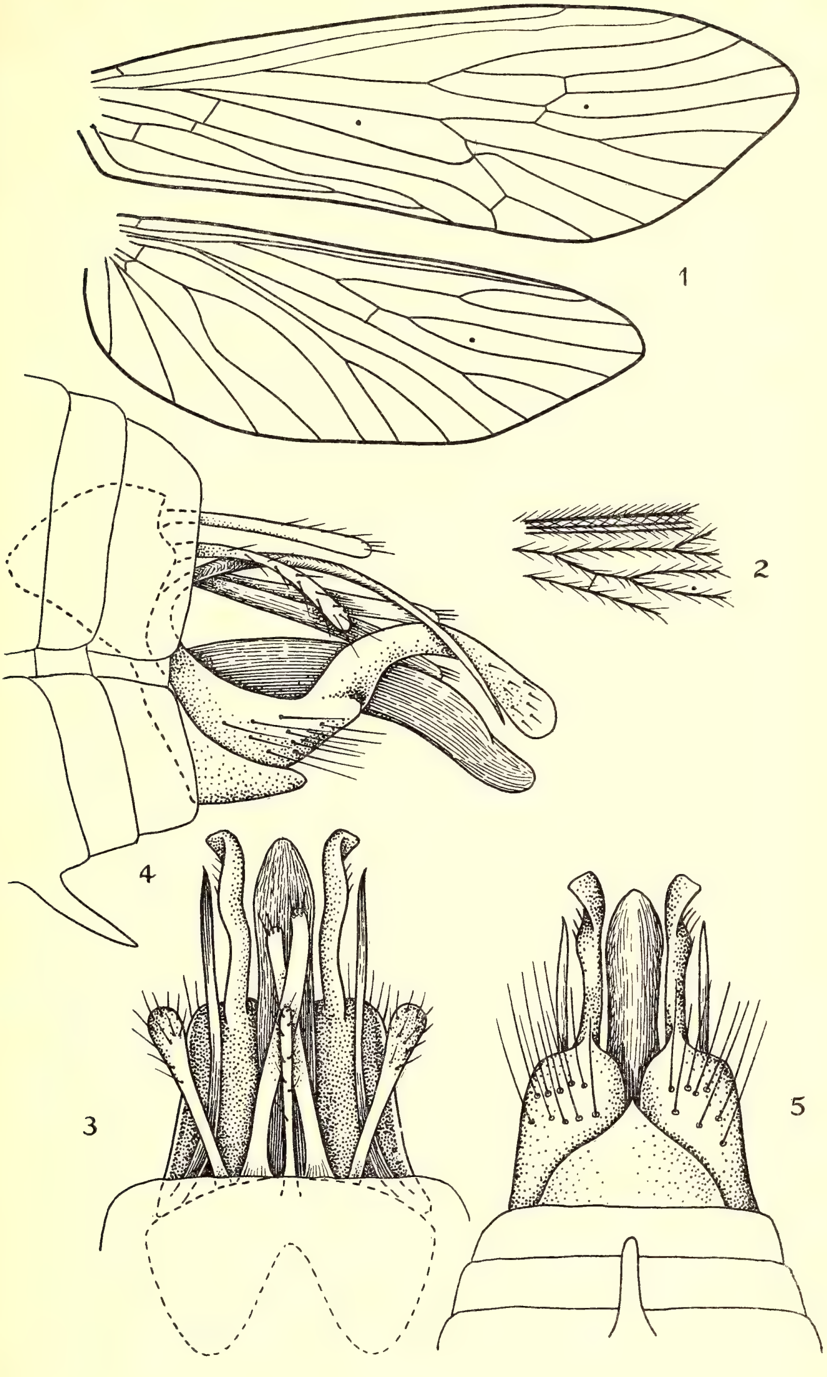

3

Goëra kursea sp. n., ♀.—Fig. 1, wings. Fig. 2, apex of the abdomen, ventral.
Goëra kalimpa sp. n., ♀.—Fig. 3, wings. Fig. 4, apex of the abdomen, ventral.



Goëra minor sp. n., ♂.—Fig. 1, wings. Fig. 2, portion of the posterior wing. Fig. 3, genitalia, dorsal. Fig. 4, lateral. Fig. 5, ventral.

Goëra atra sp. n. Pl. 2. Figs. 1-2.

Insect blackish. Neuration conforming to the usual pattern in the genus. The abdomen terminates in a pair of processes which are rather shorter and blunter than is usual with species of *Goëra;* structures connected with the vagina very strongly chitinized; a short (? broken), wide process to the sixth sternite, flanked on each side by one or two small teeth or tubercles. Spurs, 2, 4, 4.

Length of the anterior wing ♀ 9 mm.

N.-E. Burma: Kambaiti, 11-v-1934, R. Malaise.

Type ♀ in the collection of the Stockholm Museum. A ♀ paratype in the British Museum collection.

The unusual colour for a *Goëra* should render this species easily recognizable.

Goëra kursea sp. n. Pl. 3. Figs. 1-2.

Having regard to the similarity in neuration in both sexes in this genus, there should be no difficulty in correctly associating the males on this character, and I have therefore described this species from a female type.

Both neuration and the structures connected with the vagina serve to identify the species in the female sex.

The insect is brownish and in the anterior wing, fork no. 1 extends about halfway across the upper margin of the discoidal cell and is rather broad. The structures of the vagina are shown in the accompanying figure. Spurs 2, 4, 4.

Length of the anterior wing ♀ 10 mm.

Sikkim: Kurseong, 7 to 20-vi-1922, Fletcher collection.

Type ♀ in the collection of the British Museum.

Goëra kalimpa sp. n. Pl 3. Figs. 3-4.

Insect brown; in the anterior wing, fork no. 1 is long and narrow, extending more than halfway along the upper margin of the discoidal cell; structures of the vagina differing from those of *kursea* as shown in the figure. Spurs 2, 4, 4.

Length of the anterior wing ♀ 9 mm.

Sikkim: Kalimpong, Lindgren collection.

Type ♀ in the collection of the British Museum.

Goëra minor sp. n. Pl. 4. Figs. 1-5.

Insect small and yellowish. The type was collected in fluid and is considerably denuded as to the anterior wings; in the posterior, the nervures are set with stout hairs directed outwards, an unusual vestiture. Spurs 2, 4, 4.

Genitalia ♂.—Ninth tergite cut away above; in the cavity is a pair of slender superior appendages with dilated apices as seen from above, from the side, slightly arched; between them is a central process a little shorter than the appendages; beneath this is a pair of long, rod-like processes, crossing at the truncate apices which are armed with a few bristles; penis long and stout, curving slightly downward; inferior appendages branched; there is a long, spine-like upper branch, curving upwards and distally, adjacent at its base to the margin of the ninth segment as seen from the side also and, a lower branch, much stouter and elbowed so that its apical half is curved and directed distally; from beneath, the base of the appendage is stout and the apex of the lower branch is turned slightly outward; apical margin of the ninth sternite strongly produced to form a triangle with a slender, produced apex; a strong ventral process to the sixth sternite.

Length of the anterior wing ♂ 5 mm.

Burma: Washaung, 20k. east of Myitkyina, 16-vii-1934, R. Malaise.

Type ♂ in the collection of the Stockholm Museum.

Goëra mandana sp. n. Pl. 5. Figs. 1-6.

Insect light ochraceous; maxillary palpi ♂, two-jointed, basal joint small, terminal joint capable of being extended so as to form a membranous sac which is covered on the inner surface with dark androconia towards the basal half, and with pale androconia in the apical half; there is a small, membranous branch at the base, carrying a tuft of black hair; labial palpi, basal joint very short, second and third much longer, approximately equal; wings, neuration of the typical *Goëra* pattern; fork no. 3 of the anterior wing long. Spurs, 2, 4, 4.

Genitalia ♂.—Dorsal margin of the ninth tergite widely and deeply excised; in the cavity thus formed are three processes, the two outer, short, one directed asymmetrically outwards, possibly broken in the type; the central process rather longer, with a truncate apex; beneath these is a pair of strongly chitinized, asymmetric processes, the one in the form of a very fine spine, the other stouter, with a flattened, blade-like apex; penis with a membranous apical part, curled and terminating in a strongly chitinized point; it is armed on its upper surface with a pair of short and very strongly chitinized, acute spurs; there is also a small, concave plate on the upper surface before the apex; penis-sheaths stout, bent downward from about midway; inferior appendages apparently with two joints fused together, three-branched; basal (?) joint very broad; the lower branches more strongly chitinized than the other two; from beneath, straight and divergent; behind this are the upper branches which are semi-transparent and plate-like, the inner wider than the outer, separated from each other by a rounded excision; from the side, the upper branches are the longest; ninth segment from beneath, produced in a broad triangle; a large, comb-like structure to the sixth ventral segment.

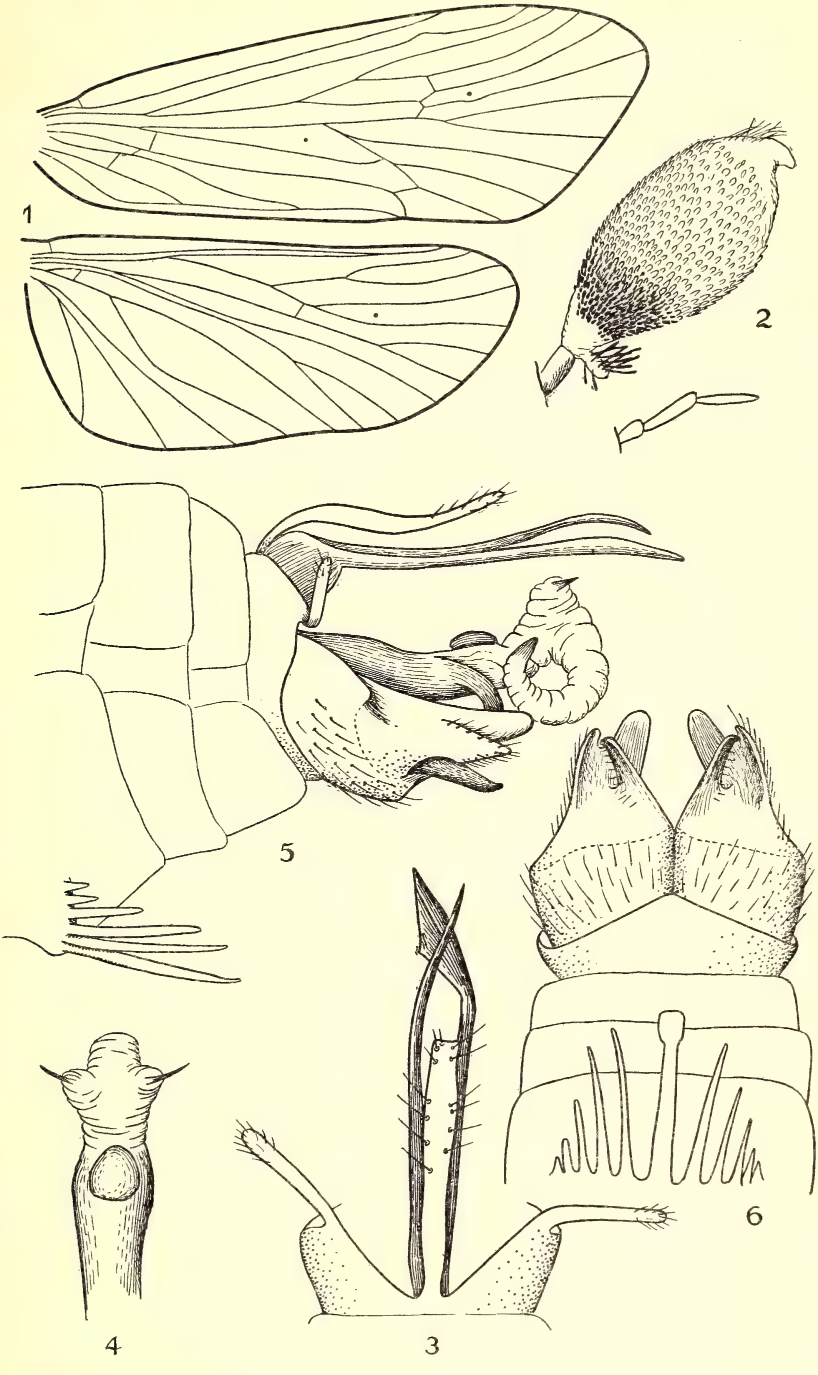
Length of anterior wing ♀ 8 mm.

Andamans: Mt. Harriet, 1,200 ft., 6-iv- 7-v-1927, Ferrar coll.

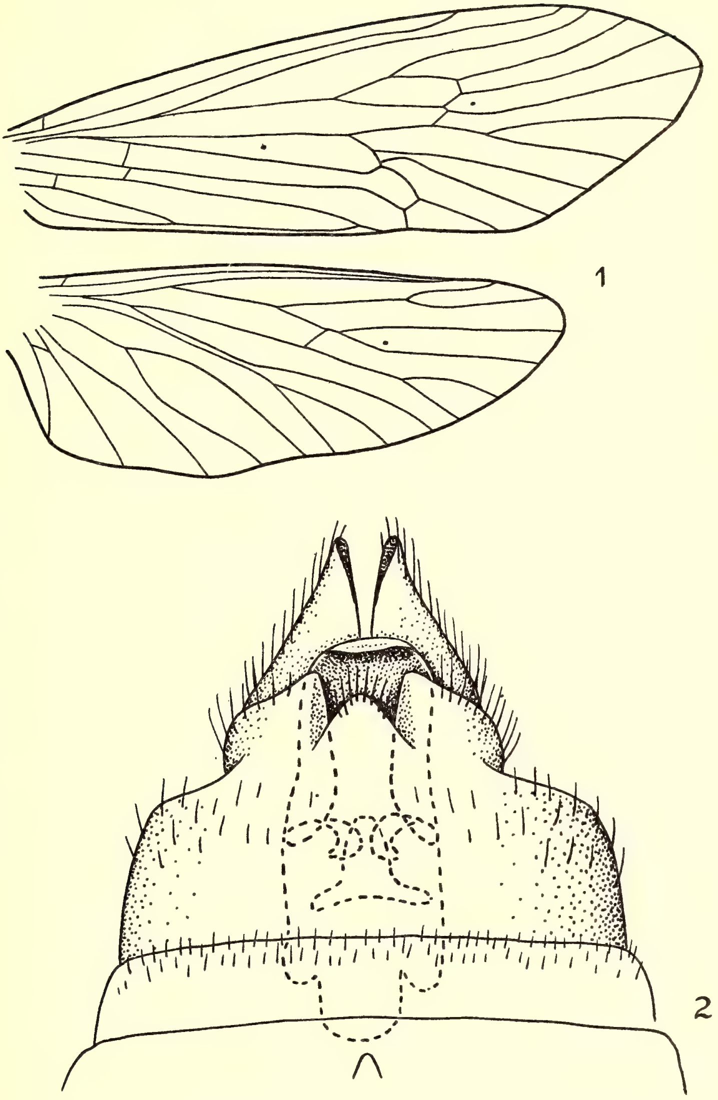
Type ♂ in the collection of the British Museum.

Goëra mishmia sp. n. Pl. 6. Figs. 1-2.

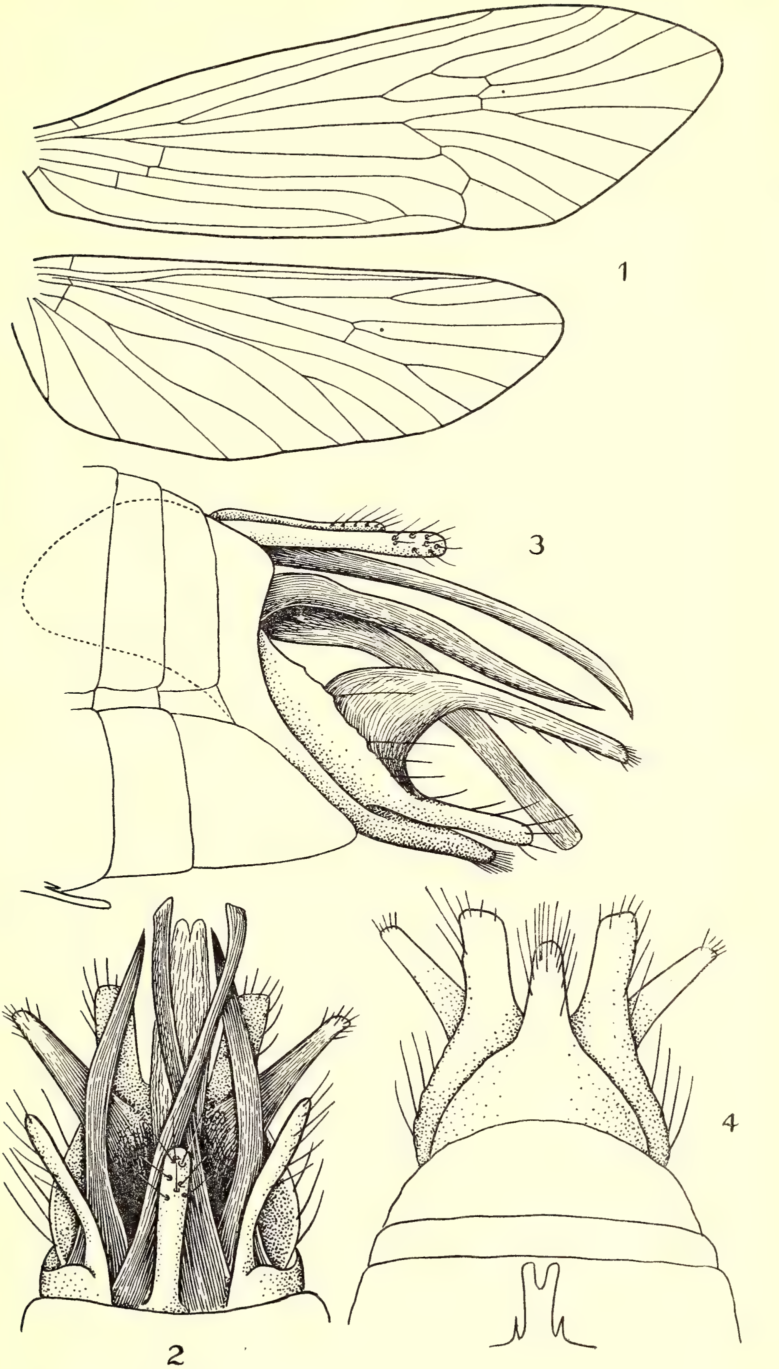
Insect yellowish-brown, unusually small; wings clothed with dense, yellowish pubescence; neuration conforming to the usual



Goëra mandana sp. n., ♂.—Fig. 1, wings. Fig. 2, palpi. Fig. 3, dorsal processes. Fig. 4, penis, from above. Fig. 5, genitalia, lateral. Fig. 6, ventral.



Goëra mishmia sp. n., ♀.—Fig. 1, wings. Fig 2, apex of abdomen, ventral.



Goëra rumabia sp. n., ♂.—Fig. 1, wings. Fig. 2, genitalia, dorsal. Fig. 3, lateral. Fig. 4, ventral.

Goëra pattern; in the anterior wing, the eighth apical sector is bent upwards nearly to meet the seventh towards its base; structure of the vagina as shown in the figure. Spurs 2, 4, 4.

Length of the anterior wing ♀ 6 mm.

Assam: Mishmi Hills, Lohit River, vi-1935, M. Steele.

Type ♀ in the collection of the British Museum.

Goëra nigricornis Navás.

Goëra nigricornis Nav., Rev. Ac. Cienc. Fis. Nat. Zaragoza, 15, p. 39, 1932.

Navás describes this species as follows:—

'Caput fulvum, fulvo pilosum; oculis nigris; antennis nigris, primo articulo fulvo, fulvo piloso, elongato, longiore spatio interoculari.

'Thorax inferne fuscus, superne fulvo-ferrugineus, mesonoto ad latera fuscescente; pilis fulvis.

'Abdomen fulvo-flavum, primo segmento subfusco, appendicibus fulvo-flavis.

'Pedes fusco-nigri, tarsis ferrugineo-fulvis; calcaribus fusconigris; tibiis posterioribus ferrugineis.

'Ala anterior apice parabolico, pubescentia densa et reticulatione ferrugineis; cellula discali breviore suo pedunculo; furca apicale 1 longa, ad medium cellulae discalis penetrante; membrana fulvo leviter tincta in speculo suborbiculari in apice areae cubitalis laevi, hyalino.

'Ala posterior membrana levissime fulvo tincta; furca apicali 2 breviter, 3 longius pedunculata; reticulatione forti, conspicua, fusca, itemque pilis fimbriisque fuscis.

'Long. corp. ♀ 9 mm.

'Long. al. ant. 10.6 mm.

'Long. al. post. 8.2 mm.

'Patria. Khandala (Bombay), 20-x-1929.'

Type ♀ in the Navás collection.

Goëra rumaba sp. n. Pl. 7. Figs. 1-4.

General appearance light fulvous; antennae fairly stout, basal joint not so long as the greatest breadth of the head without the oculi; maxillary palpi three-jointed, partly membranous, first joint small, strongly chitinized and pigmented, second about three times the length of the first, membranous, but with a strongly chitinized and pigmented nodule at the base, third, membranous, slightly longer than the second; labial palpi, basal joint short, second and third equal, rather longer than the first; wings rather broad, clothed mainly with ordinary hairs but there are some clavate hairs in the post-costal region, no scales; no scales or clavate hairs on the posterior wing; spurs 2, 4, 4.

Genitalia ♂.—The apical margin of the ninth tergite bears at its centre three membranous processes, the central, rather the shorter; beneath them is a pair of long, strongly chitinized spines crossing each other about the middle, apices truncate; there are two, long, rod-like intermediate appendages with acute apices;

beneath these is a long, straight penis with an excised apex; inferior appendages bifurcate; the upper forks from above, widely divergent on each side of the penis, with wide bases, tapering to truncate apices; the direction of the forks appears to vary in individuals; lower forks long, rectangular, with truncate apices; from the side, the upper and lower forks are separated by an excision represented by three sides of a square; the ninth sternite strongly produced, the centre of its margin still further produced in a narrow, fringed process with a rounded apex; the sixth sternite bearing a bifurcate process with a spine on each side of its base; this process is variable in shape in individuals.

Length of the anterior wing ♂ 9 mm.

N.-E. Burma: Kambaiti, 6,800 ft., 9-iv-1934, R. Malaise.

Type ♂ in the collection of the Stockholm Museum. Paratypes in the collection of the British Museum.

Goëra tridens sp. n. Pl. 8. Figs. 1-4.

Insect deep, yellowish brown, wings covered with dense pubescence of the same shade. Spurs 2, 4, 4.

Genitalia ♂.—Ninth tergite cut away to leave a wide cavity in which is a pair of slender superior appendages and between them, a central process, similar in shape but slightly longer; immediately beneath this process is a pair of very long, stout spines, crossing at their apices; beneath these is the penis, furnished with a trough-shaped lower penis-cover with excised apex; inferior appendages branched at the apices; from the side, basal part bulbose, covered with very stout hairs; lower branch, from above, slender, terminating at its apex in a hook; from beneath, it tapers to an acute apex, the upper branch being shorter, oval and with a rounded apex; process to the sixth sternite formed of three prongs, the central the longest.

Length of the anterior wing ♂ 8 mm.

India: Kharsis. (McLachlan collection.)

Type and paratypes ♂ in the collection of the British Museum.

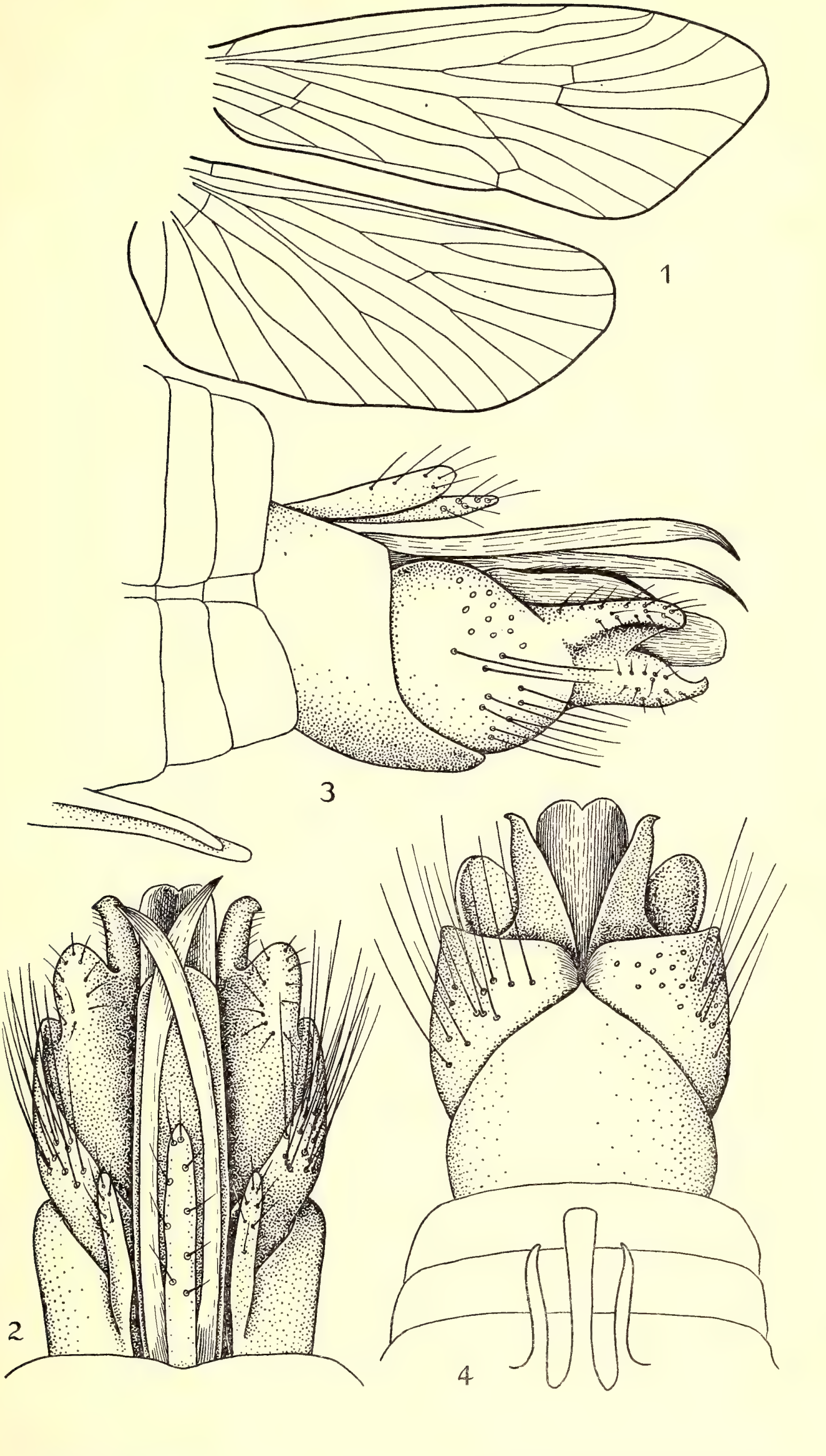
Goëra vulpina Hagen. Pl. 9. Figs. 1-7.

Mormonia vulpina Hagen *partim,* Verh. zool.-bot. ges. Wien, ix, p. 208, 1859.

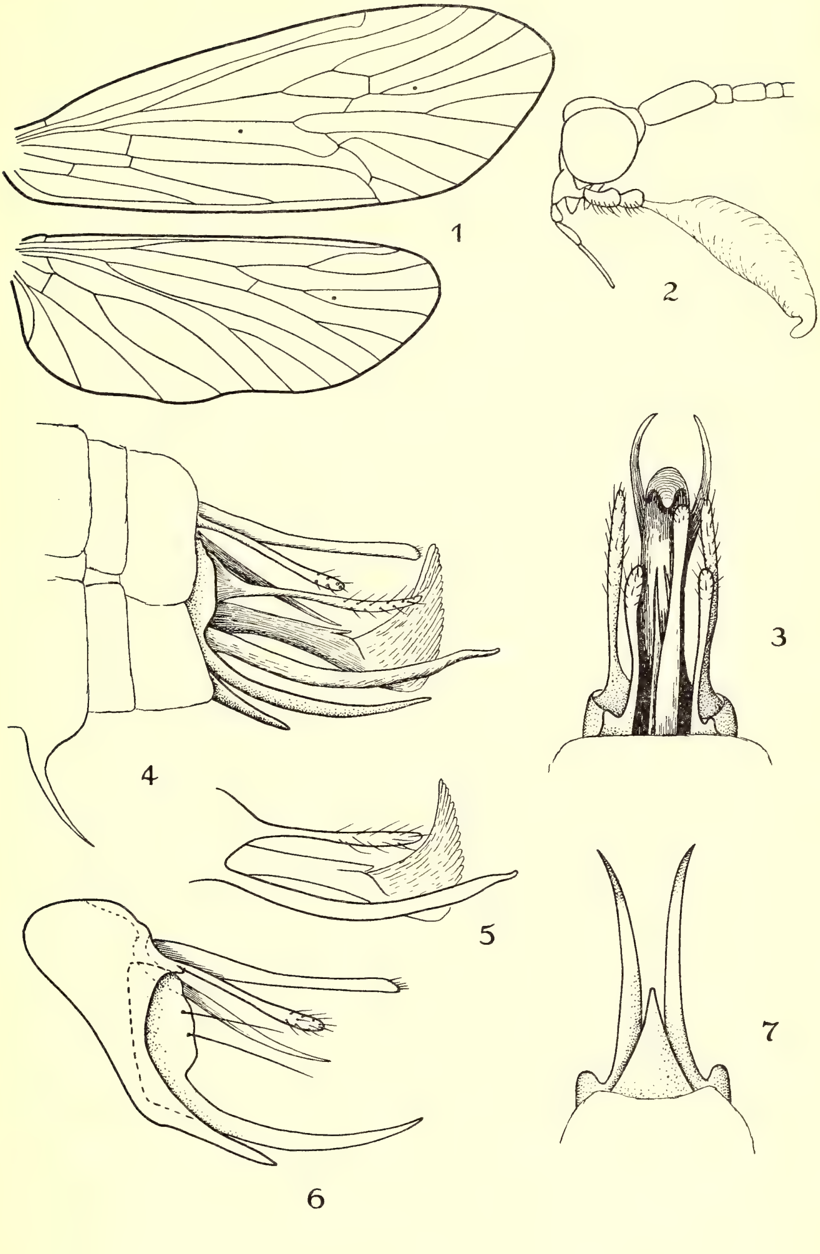
Goërodes vulpina Ulmer *nec* Hagen, Coll. Selys, fasc. vi (i), p. 40, fig. 64, 1907.

Goërodes vulpina Ulmer *nec* Hagen, Gen. Insect. fasc. 60a, p. 106, 1907. Deut. ent. Zeit., 1915, p. 75, 1915.

Description of the ♂. Insect light ochraceous generally; basal joint of the antenna about as long as the width of the head without the oculi; second joint short, about half the length of the third which is twice as long as each of the remaining joints towards the base, but these tend to become longer towards the apex; the third joint bears an impressed line halfway round its circumference on the inner side so that it is probably formed by the welding together of two joints; maxillary palpi three-jointed, a fringe of dark hairs on the under side; when cleared in KOH, it may be seen that the two basal



Goëra tridens sp. n., ♂.—Fig. 1, wings. Fig. 2, genitalia, dorsal. Fig. 3, lateral. Fig. 4, ventral.



Goëra vulpina Hagen, ♂.—Fig. 1, wings. Fig. 2, head and palpi. Fig. 3, dorsal processes. Fig. 4, genitalia, lateral. Fig. 5, penis and intermediate (?) appendages. Fig. 6, dorsal processes, upper penis-cover, inferior appendages and ninth sternite. Fig. 7, ventral plate and inferior appendages, from beneath.

joints are small and more strongly chitinized than the third which forms a membranous sac, large, upturned in front of the face, the extreme apex constricted and bent; the joint is clothed with a few scattered and broadened hairs; labial palpi with a small basal joint, second more than twice the length of the first and shorter than the third; legs, anterior pair rather darker than the rest of the insect; spurs 1, 4, 4; anterior leg with a single short, stout spur and a heavily fringed tibia; wings thickly clothed with yellowish pubescence; anterior, discoidal cell short and broad, fork no. 2 with a minute foot-stalk; in the posterior wing, fork no. 2 with a long foot-stalk

Genitalia ♂.—Ninth dorsal segment retracted within the eighth; the centre of its margin is produced in three long, strongly chitinized rods of which the central is the longest; the apices of the outer (possibly superior appendages), slightly dilated; beneath them is a pair of long, transparent spines, perhaps an upper penis-cover; penis straight with a membranous apex shaped like a foot with the toes turned up as seen from the side; there is a small dorsal spur at the base of the membranous apex; then there is a pair of bifurcate processes, possibly intermediate appendages, the upper forks long and fringed, appearing above the penis, the lower still longer and slightly upcurved with sinuous apices but no fringes; inferior appendages in the form of a pair of strongly chitinised spines, about the same length as the penis, curving upward; centre of the margin of the ninth ventral segment produced in a ventral plate forming a stout spike; a strong and long down-curving process to the sixth ventral segment.

Length of anterior wing ♂ 7 mm.

Ceylon: Rambodde, (Nietner).

The Hagen series of cotypes of his species *Mormonia vulpina* is mixed, containing at least one insect either a *Goëra*, or very closely allied to species in this genus, and others belonging to a genus in the *Lepidostomatinae*.

Hagen, whilst he refers to scales on the wings of the males of all the other *Mormonia* species he describes, writes of *vulpina* in the following terms, '*alis anticis luteis, luteo hirtis* (masc); there is no mention of scales.

I describe *vulpina* from a ♂ example, bearing a label in Hagen's own handwriting, in the type series to which he referred and which was received in exchange from the Harvard Museum of Comparative Zoology, Cambridge, Mass., U.S.A., where the Hagen collection is lodged. This description conforms with that of Hagen.

Ulmer, in the Cat. Selys. Coll., figures the wings of one of the two ♀ cotypes in the Brussels Museum but does not actually designate this ♀ as the type of the species; his figure shows clearly that the Brussels insect belongs to the sub-family of the *Lepidostomatinae* in which nearly all the known ♂ species in Ceylon bear scales on the wings; moreover, the female wing of a *Goëra* species or of a species with a neuration such as I have figured, would not resemble Ulmer's figure.

I am therefore of opinion that the Brussels females belong to a different species, and I here designate the male cotype, mounted in balsam and figured here, the type of *vulpina*. This type has been returned to Mr. Banks, at the Harvard Museum.

BRACHYCENTRINAE Ulmer.

Brachycentrinae Ulm., Abh. Natur, Ver. Hamb., 18, p. 85, 1903

Basal joint of the antenna shorter than the width of the head with the oculi. Maxillary palpi cylindrical, hairy, curved upward, not applied against the face, three-jointed, basal joint shorter than the others; labial palpi longer than the maxillary palpi, stout, basal joint short, second and third approximately equal; wings varying in form, usually rather broad, posterior generally much shorter than the anterior; no grooves or folds in either pair; pubescence usually dense but never mixed with scales; neuration generally differing in the sexes; in the anterior wing, the discoidal cell is ordinarily short and broad; apical forks nos. 1, 2, 3 and 5 usually present in the ♂ and often fork no. 4 in addition in the ♀; in the posterior wing, discoidal cell is usually open; ordinarily, forks nos. 1 and 5 in the ♂, with frequently additional forks in the ♀; a transverse nervure connects the radial sector to the medius; spurs varying; often a lobe or tooth to the 7th ventral segment.

KEY TO THE BRACHYCENTRINAE.

1.	Spurs 2, 3, 3.	BRACHYCENTRUS
	Spurs 2, 2, 2.	MICRASEMA

Brachycentrus Curt.

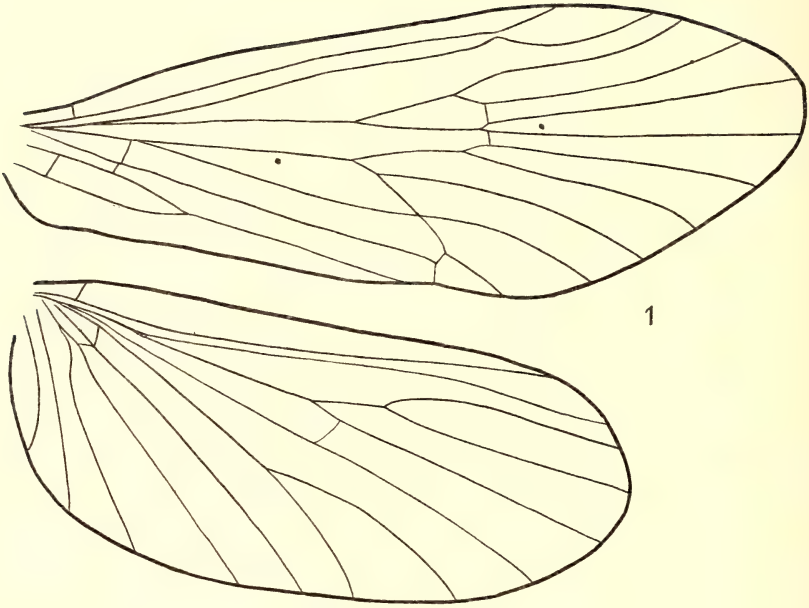
Brachycentrus Curtis, Phil. Mag., 1834, p. 215.

Spurs 2, 3, 3.

Antennae slender, about the length of the wings, basal joint stout, maxillary palpi of the male upturned, three-jointed, middle joint longer than the first or last; maxillary palpi of the female long and slender, terminal joints thin, third joint the longest, second, fourth and fifth nearly equal in length, basal joint short; anterior wings moderately broad and elongate, without folds or scales in the male; apical margin somewhat oblique, much more oblique and produced in the female than in the male; in the anterior wing male, forks nos. 1, 2, 3 and 5 are present, all extending to the anastomosis; in the anterior wing female, forks nos. 1, 2, 3, 4 and 5 are present; no. 4 does not reach the anastomosis; discoidal cell short and broad in both sexes, more particularly in the female; posterior wings much shorter than the anterior, broad and very obtuse (slightly less so in the female); discoidal cell open; only forks nos. 1 and 5 present in the male, but nos. 1, 2, 3 and 5 in the female; lower branch of the sector connected with the medius by a nervule.

Genitalia male.—A large dorsal hood covers the various genital appendages. The species are best separated by the form of the inferior appendages.

Genotype: *Brachycentrus subnubilus* Curt.



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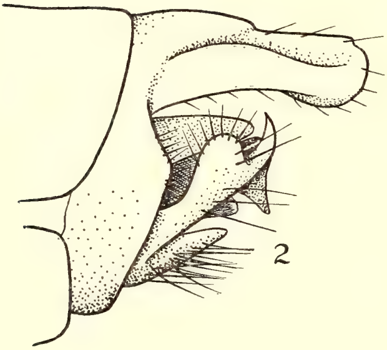

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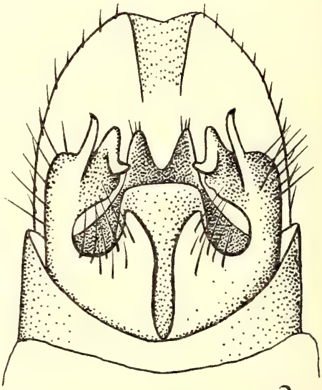

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Brachycentrus kozlovi Mart., ♂.—Fig. 1, wings. Fig. 2, genitalia, lateral Fig. 3, from behind.

The species belonging to this genus are wont to appear in great swarms, early in the season. The females are frequently seen carrying an ovoid mass of bluish-geen eggs at the oviducts; if the insect be examined when in this condition, it will be noticed that the terminal segments are inturned to make a kind of cup in which the eggs are carried.

Brachycentrus kozlovi Martynov. Pl 10. Figs. 1-3.

Brachycentrus kozlovi Mart., Ann. Mus. Zool. Ac. Sci. Peters., xiv, pp. 291-4, figs. 6-9, 1909.

Head and throax fuscous with light, honey-coloured hairs; oculi black; antennae fuscous with pale annulations; palpi and legs testaceous; spurs 2, 3, 3; wings greyish with light honey-coloured pubescence.

Genitalia ♂.—Ninth dorsal segment produced in a large hood with a slightly excised apical margin; this hood obscures all the genital parts from above; upper penis-cover deeply excised; penis with a swollen and slightly cleft apex; lower penis-cover in the form of a rectangular plate; inferior appendages rather complicated; in each, there is a lower, strongly chitinized, triangular basal fork separated from the remainder of the appendage by a deep rounded excision as seen from beneath; the apical portion of the appendage consists of two leaves, the outer from behind, with a strongly produced, inner, apical angle, from the side, very acute and curving upwards, the outer apical angle shorter and rounded; the inner leaf with the lower apical angle produced downward and the upper angle rounded.

Length of anterior wing ♂ 9, mm., ♀ 10-11 mm.

Kashmir: L. Vishensar, 12,000 ft., F. J. Mitchell; W. Tibet: Basgo, 20-ix-1932; Chushol, 14,228 ft., 10-viii-1932, G. E. Hutchinson.

The female insect is seen frequently with a ball of olive-green eggs carried at the oviducts. The insect bears a close resemblance to the European species, *Brachycentrus subnubilus* Curt., well-known to anglers under the popular name, the Grannom.

Micrasema McLachlan.

Spurs 2, 2, 2, those of the anterior tibiae very short. Antennae slender, about as long as the wings, those of the ♀ slightly shorter than those of the ♂, basal joint stout. Maxillary palpi ♂ greatly curved and extending to or near the apex of the basal antennal joint, not applied against the face. Anterior wings broad, oval, unicolorous, generally black, neuration obscured by dense pubescence; fork no. 3 of the anterior sometimes with a footstalk, generally sessile; discoidal cell present and short in the anterior wing, absent in the posterior; in the former wing, forks Nos. 1, 2, 3 and 5 present in the ♂, Nos. 1, 2, 3, 4 and 5 in the ♀; in the posterior wing, forks nos. 1 and 5 in both sexes; lower branch of the medius sometimes present, sometimes obsolete or partly obsolete.

Genotype: *Micrasema tristellum* McLach., here designated.

Micrasema baitina sp. n. Pl. 11. Figs. 1-4.

Insect black; fork no. 3 in the anterior wing sessile. Lower branch of the medius in the posterior wing entirely obsolete.

Genitalia ♂.—Dorsal plate forming a large triangle with a slightly excised apex; beneath it may be seen the fringed and rounded apices of the intermediate (?) appendages; penis broad and spatulate, tapering to a slender apex from the side; inferior appendages stout and two-branched, the short, sausage-shaped second branch arising from a deep, nearly right-angular excision on the inner surface towards the apex which is slightly excised.

Length of the anterior wing ♂ 4.5 mm.

N.-E. Burma: Kambaiti, 2,000 m., 4-iv-1934; 7,000 ft., 30-iv-1934; 2,000 m., 12-v-1934.

Type ♂ in the collection of the Stockholm Museum. Paratypes ♂ and ♀ in the Stockholm and the British Museum collections.

Micrasema punjaubi sp. n. Pl. 12. Figs. 1-2.

The single example known of this species has been mounted in balsam and I am unable to describe its general appearance. In the anterior wing, fork no. 1 extends nearly to the middle of the upper margin of the discoidal cell; posterior wing, the lower branch of the medius is partly obsolete.

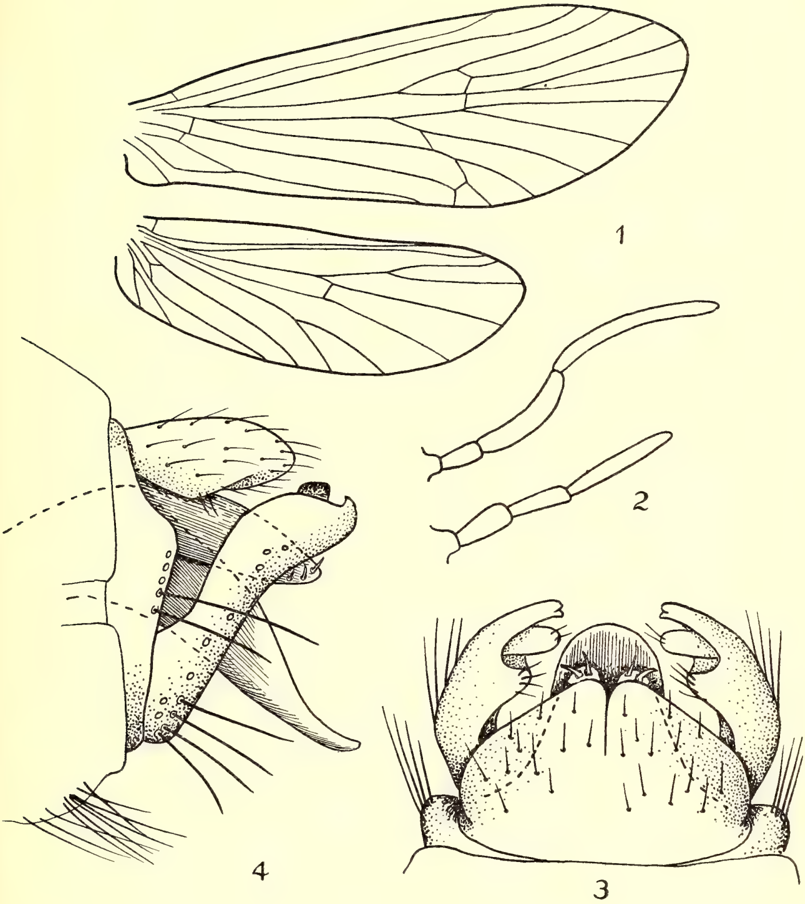
Genitalia ♂.—From above, the dorsal plate is formed of a pair of triangular plates fused together on the ventral side and tectiform on the upper; intermediate appendages broad, with a row of short, stout spines along the apical margin; penis short and straight; inferior appendages two-jointed, basal joint large, terminal joint very short.

Length of the anterior wing ♂ 5 mm.

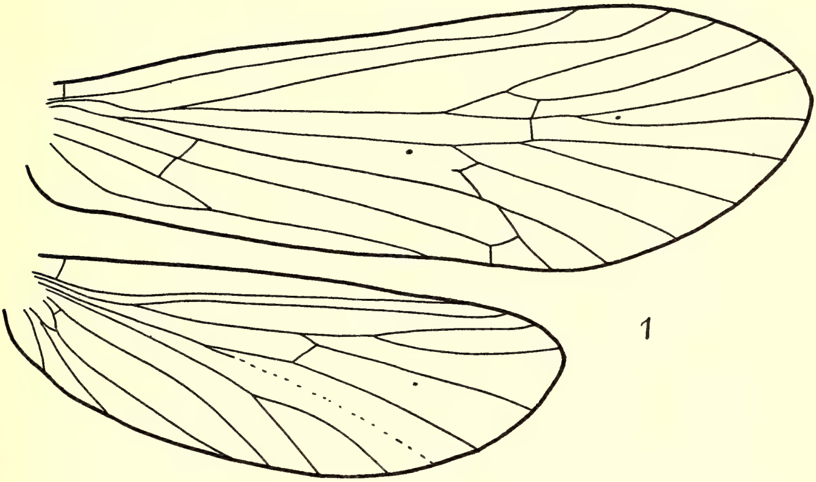
India: Punjab, R. Uhl, Chotah Bagahal, vi-1914, G. C. L. Howell.

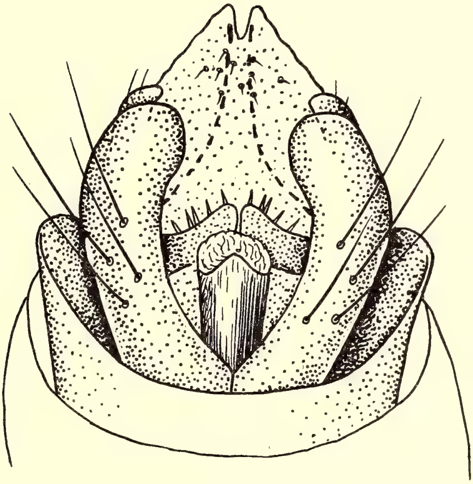
Type ♂ in the author's collection, now in the British Museum.

(To be continued).



Micrasema baitina sp. n., ♂.—Fig. 1, wings. Fig. 2, palpi. Fig. 3, genitalia, dorsal. Fig. 4, lateral.





Micrasema punjaubi sp. n., ♂.—Fig. 1, wings. Fig. 2, genitalia, ventral.

AN ADDITIONAL LIST OF BIRDS FROM HYDERĀBAD STATE.

BY

SÁLIM ALI.

The following species, not listed in my report of the Hyderābād State Ornithological Survey (concluded on p. 454 of volume xxxvii), were met with mainly during a visit to Mūlūg (Warangal District) in company with Col. R. Meinertzhagen in February 1937. Other species noted, or records brought to my notice since the Survey, have also been included. Specimens of several species not collected during the Survey have since been procured which has enabled a determination of the races occurring in Hyderābād.

SPECIES NEW TO THE SURVEY LIST.

Locustella nævia straminea Seebhom. The Eastern Grasshopper-Warbler.

o? 22-2-37 Mūlūg 1,500 ft. (Meinertzhagen Collection). Two others shot on 24 and 26 February, not preserved.

Fairly common in tall coarse grass on the margin of Rāmappa Tank. Flushed singly. Diving into the stems after a short flight, scuttling swiftly through the rootstocks, and difficult to flush a second time.

Chætornis locustelloides (Blyth). The Bristled Grass-Warbler.

♂, o?, o? 24 and 25-2-37 Mūlūg 1,500 ft. (Meinertzhagen Collection).

Fairly common in the same facies as the foregoing. Flushed singly. Has a habit of soaring a few feet above the grass every now and again, flying indirectly—up and down and zig-zag—for a short distance, and then diving into the stems. Similar behaviour to that of *Schœnicola platyura.* Difficult to flush a second time. Like *Locustella* it works its way swiftly through the rootstocks and rises several yards away from where one expects it to.

Emberiza striolata (striolata Licht.). The Striolated Bunting.

Noted : Daūlatābād Fort 29-2-36 and 3-12-37.

Males singing from ramparts, etc. Rich *whee-chi-whee-wichee* ending in an extra, subdued, *chi.* On 29 February a pair was nest-building in a niche in Chini Mahal. Both sexes were bringing grasses and turning in the unfinished shallow cup.

Ptyonoprogne rupestris (Scop.). The Crag Martin.

o? 31-12-37 Daūlatābad Fort (not preserved). Wing 134 mm. Several seen about the rock scarps. Obviously a winter visitor.

Anthus richardi richardi Vieill. Richard's Pipit.

oo 20-2-37 Mūlūg, 1,500 ft. (Meinertzhagen Collection).

Shot near Rāmappa Tank. Several seen.

Ichthyophaga ichthyaëtus subspecies? The Grey-headed Fish-Eagle.

♂ imm. 21-2-37 Mūlūg, 1,500 ft. (Meinertzhagen Collection).

Colours of bare parts : Iris yellowish-brown ; bill horny brown, greyish plumbeous on lower mandible ; legs and feet greyish creamy-white or ivory ; claws brownish-black.

Shot at sunset off old nest—a huge collection of twigs, about 3 feet deep—which on the same morning was being added to by a *Neophron percnopterus* ! The latter was shot by Col. Meinertzhagen as it came to the nest with a twig in its bill. It is curious that both these species should be actively interested in the same nest. The original owners—presumably the Fish-Eagles—apparently roosted at night in or near the nest. When the specimen was shot no Neophrons were about. The Eagles were observed at the nest in the morning also, but no Neophrons were in the vicinity then.

The nest was about 30 ft. up in the fork of a large *Albizzia* tree, 2 furlongs from a tank among low, stony hillocks in deciduous forest.

The crop of the specimen contained portions of a fish.

Circus melanoleucus (Forst.). The Pied Harrier.

Colours of bare parts: Iris bright lemon yellow; cere greenish-yellow, upper mandible and terminal half of lower mandible blackish-brown; base of lower mandible plumbeous; gape greenish-yellow; legs and feet bright chrome yellow; claws brownish-black.

Shot in open scrub country and rank grassland bordering Rāmappa Tank.

♂ 24-2-37 Mūlūg, 1,500 ft. (Meinertzhagen Collection).

Excalfactoria chinensis chinensis (Linn.). The Blue-breasted Quail.

♂ ♀ 24-2-37 Mūlūg, 1,500 ft. (Meinertzhagen Collection).

Singly or pairs in tall grass by Rāmappa Tank. Not abundant.

Turnix maculatus tanki Blyth. The Indian Button-Quail.

♀ 22-2-37 Mūlūg, 1,500 ft. (Meinertzhagen Collection).

Several singly or in pairs in grassland near Ramappa Tank.

Nyroca rufa rufa (Linn.). The White-eyed Pochard.

A pair shot by P. H. Allen at Nālgonda, lat. 17° 22′. (*Vide* Stuart Baker, *Indian Ducks and their Allies*, p. 228.)

SPECIMENS OBTAINED SINCE THE SURVEY, ESTABLISHING SUBSPECIES OR CONFIRMING SIGHT RECORDS.

Emberiza melanocephala Scopoli. The Black-headed Bunting.

o? 17-2-37 Mūlūg, 1,500 ft. (Meinertzhagen Collection).

Noted also at Daūlatābād between 18 November and 31 December as fairly common.

Chrysocolaptes festivus (Boddaert). The Black-backed Woodpecker.

oo 18-2-37 Mūlūg, 1,500 ft. (Meinertzhagen Collection).

Noted also at Ajanta (28-12-37) in deciduous forest on hillside.

Micropus melba bakeri. Hartert. The Indian Alpine Swift.

♂ ♀ 20-2-37 Mūlūg, 1,500 ft. (Meinertzhagen Collection).

♂ W=200 mm.; testes 16×6 mm. ♀ W=198 mm.; ovarian follicles ca. 1 mm. in diameter.

Several birds seen hawking the bugs (*Agnoscelis nubila* Fb.) at heights of 150-200 ft. in the vicinity of Rāmappa Tank. Their gape and gullet were packed with them. Probably breeding on the crags nearby.

Noted also at Daūlatābād, 24-12-37. About 100 birds flying low in overcast weather.

Ketupa zeylonensis leschenaulti (Temm.). The Bengal Brown Fish-Owl.

♂ ♀ 21-2-37 Mūlūg, 1,500 ft. (Meinertzhagen Collection).

♂: testes 10×5 mm. ♀: largest ovum 7 mm. diameter.

Hieraëtus fasciatus fasciatus (Vieill.). Bonelli's Eagle.

♀ (W=ca. 530 mm.) 27-12-37 Daūlatābād, ca. 1,800 ft.

Shot in the morning off large stick nest on ledge of rock-scarp. When the nest was visited again the same evening the male was on it. He sat tight on the eggs until the climber reached the ledge and was within a few feet of him. C/2 taken, measuring 70×53 and 68×53 mm. (St. Xavier's College Museum.) Nest sparsely lined with small dry leaves. The stomach of the specimen contained pieces of skin and claws of a lizard (*Varanus?*) and some green vegetable matter.

Elanus cæruleus vociferus (Latham). The Black-winged Kite.

♂ 23-2-37 Mūlūg, 1,500 ft. (Meinertzhagen Collection).

One of a pair on tree in coarse grassland by Rāmappa Tank. Largest ovum 3 mm. in diameter. Stomach contained compact ball of rat fur and bones.

Porphyrio poliocephalus poliocephalus (Latham). The Indian Purple Moorhen.

♀ 19-2-37 Mūlūg 1,500 ft. (Meinertzhagen Collection).

Largest ovum 9 mm. diameter. Several specimens shot for Mallophaga on a reedy, lotus-covered tank.

Phylloscopus griseolus Blyth. The Olivaceous Willow-Warbler.

In my note on this species (vol. xxxvi, p. 719) I said: 'Met with singly in tall trees in deciduous forests.' Since then I find that it is much more addicted to old fort walls and escarpments, often running up their faces like a tree- or wall-creeper.

Merops superciliosus javanicus Horsf. The Blue-tailed Bee-eater.

A few seen in grass and scrub jungle near Rāmappa Tank, Mūlūg, 17-2-37.

Pandion haliaëtus (Linn.). The Osprey.

Noted at Rāmappa Tank, Mūlūg, 17-2-37.

Falco peregrinus peregrinator Sund. The Shahin Falcon.

Noted on Daūlatābād Fort 21-12-37. A single bird on ledge of rock-scarp feeding on a pigeon squab within 10 yards of several adult pigeons! The slaty-blue upper parts and rufous thighs and undertail were diagnostic.

Falco jugger. J. E. Gray. The Lagar Falcon.

A pair nesting on a small minaret at Bibi-kā-Makbara, Aūrangābād, 29-12-37.

SUPPLEMENTARY OBSERVATIONS ON THE MUNNAR SECTION OF THE ORNITHOLOGICAL SURVEY OF TRAVANCORE AND COCHIN.

BY

J. B. PRIMROSE,

Wilson College, Bombay.

These notes are the result of two visits to Munnar, one from April 29th to June 1st, 1937, and one from April 9th to May 31st, 1938. My earlier arrival in 1938 enabled me to observe a larger number of the winter visitors who apparently leave before the end of April. As it happened, several birds observed by Mr. Sālim Ali had already departed before the 9th of April. Before going on any further, I must pay tribute to the excellence and accuracy of the observations made by Mr. Sālim Ali and his party during the survey of Travancore. The eight parts of the *Journal* of the B.N.H.S. were always found helpful and accurate too.

I should say that I shot no birds, and so I am ready to admit that some of my observations may be liable to question. All I can say is that as great care was taken as was possible, and that several observations made have been omitted through inability to give satisfactory confirmation. I also saw some birds which I could not confidently identify, and I think that there are probably more birds in Munnar than have yet been recorded.

In May 1937, the weather in Munnar was broken and showery, and the Monsoon winds had not begun by the 1st of June. In 1938 the weather was broken till the end of April. Early in May the S. W. winds began, accompanied by mist and long drizzles. On May 14th the N. or N.E. wind re-asserted itself, and a spell of fine weather followed which lasted till near the end of the month when heavy rain began to fall. It was noticed that when the rain fell in May, a general exodus of birds began from Munnar. During the return of fine weather, a few returned, but the majority remained away. Many of the birds that left Munnar may simply have moved to other areas in the High Range, for one of the features of the Kanan Devan Hills is the extraordinary variation in annual rainfall within a limited area. At the western edge, on the Pettimudi Estate, nearly 400 inches of rain have been recorded. Lockhart and Periakanal to the south record from 100 to 90 inches, and to the east, at Top Station and Chittavurrai the average fall is from 60 to 50 inches. Munnar itself has an average of 153 inches, and Devicolam, 5 miles away has an average of 113 inches. Of the Munnar average of 153 inches, about 107 inches fall in June, July, and August. I have had some opportunity of seeing the bird-life outside the immediate area of Munnar, and the impression I have gained while visiting some of the estates east of Munnar during the second half of May was that birds were still being seen there which were no longer being seen in Munnar itself. I suggest that there is a considerable amount of local migration within the limits of the Kanan Devan Hills.

I think also that birds on migration northwards fly over these hills by a route from the Pullivassal Gap to Munnar town and then up the Kanniamallai river to the Nyamakad Gap, and thence *via* Maraiur to the plains. Mr. H. A. Ragg whose estate lies on this route seems to have more records than other observers, and I think that very probably the reason is that the birds pass his estate on their southern and northern journeys.

In my notes 'S.A.' refers to records specifically stated by Mr. Sālim Ali to have been made in Munnar. They are found in the *Journal* of the B.N.H.S., vols. xxvii, 4; xxxviii, 1-4; xxxix, 1-3. My own notes are indicated by 'J.B.P.'

CORVIDÆ.

Corvus machrorhynchus culminatus. Noted as absent. S.A.

Seen in April and May, but not in large numbers. Also seen in Silent Valley and at Madupatty (25th May), and reported from Kalaar to the west. A few of these birds seem to ascend the hills in the hot weather. J.B.P.

Corvus splendens protegatus. Noted as absent. S.A. and J.B.P.

Machlolophus xanthogenys travancorensis. S.A. and J.B.P.

A few were seen as members of flocks.

Sitta frontalis frontalis. S.A. and J.B.P.

Fairly common in April but noted till the end of May.

TIMALIIDÆ.

Trochalopteron jerdoni fairbanki. S.A. and J.B.P.

Distribution wrongly given in *Fauna*, vol. i, p. 178, as S. Travancore. It should be N. Travancore, and that of the following bird *T. j. meridionale* as S. Travancore. Very common. Young birds seen early in May.

Pomatorhinus horsfieldi travancorensis. S.A. and J.B.P.

Very common and very vocal in April, but less heard in May. Seen both in sholas and on *Grevillea robusta* shade trees amongst the tea. In May commoner in the drier areas. Probably a local migrant.

PYCNONOTIDÆ.

Microscelis psaroides ganeesa. S.A. and J.B.P.

More commonly seen in April than in May, but still fairly common in May up to about the 14th; then growing scarcer till, at the end of the month, it was absent.

Molpastes cafer cafer. Noted as absent. S.A. So also J.B.P.

Otocompsa jocosa fuscicaudata. S.A. and J.B.P.

Very common. Frequently observed feeding on *Rubus ellipticus.* Once a bird hung to the fruit by its bill and vibrated its wings until the fruit was detached from the stalk. Also observed taking nectar from garden bushes, e.g. Japanese Lantern.

TURDIDÆ.

Brachypteryx major albiventris. S.A.

Doubtful. Very difficult to distinguish between this and *Eumiyas albicaudata* in the field. I found it easier to note its presence by the song than by sight. J.B.P.

Tarsiger brunnea brunnea. Not observed. Probably had already migrated. S.A. and J.B.P.

Saxicola caprata atrata. S.A. and J.B.P.

Very common. Young males were seen in late April and early May in brown plumage with white patches appearing.

Turdus simillimus mahrattensis,
T. bourdilloni. } S.A. and J.B.P.

Difficult to distinguish. Blackbirds were heard singing up to the end of May. My impression is that Bourdillon's blackbird was most common. Other observers also agree. Towards the end of May the birds seemed to be found more at the 6,000 ft. level.

Monticola solitaria pandoo. S.A. and J.B.P.

One bird seen once, at end of April.

Myophonus horsfieldii S.A. and J.B.P.

Quite common, and sang well especially when the mists came up. This bird has a high-pitched whistle repeated at intervals when feeding, less in volume than, but similar to that of the Grackle and Scaly-bellied Green Woodpecker, and greater in volume than that of the White-eye.

MUSCICAPIDÆ.

Siphia parva albicilla. Not recorded. S.A.

Twice doubtfully seen on the edge of a shola towards the end of April. The red breast caught the eye. J.B.P.

Muscicapula tickelliæ tickelliæ. Not seen. S.A. and J.B.P.

Eumiyas albicaudata. S.A. and J.B.P.

Frequently heard and seen in April, but rarely in May near Munnar. It was seen in the higher and drier areas later in May, but some of these records may be confusions with *Brachypteryx*.

Alseonax muttui. Not recorded. S.A.

One pair was seen in the Parsonage compound, in which I was staying right up to the end of May. I had almost daily opportunities of watching them. The large brown-eye with the whitish ring round it was noticeable. Mr. Sālim Ali doubts whether this bird is resident. From the fact that I saw it up till the end of May in Munnar and also at Arivikad on May 25th ca. 5,500 ft. it seems as if the *Fauna* prediction had some evidence in support of it. Cf. *Fauna*, vol. ii, p. 252. I watched carefully for signs of breeding in Munnar, but found none. The Munnar birds were quite tame. I often watched them, perching on a wire fence, and on a poinsettia bush, and making sallies to capture flies, descending occasionally to the ground. J.B.P.

Ochromela nigrorufa. Not recorded. S.A.

Very curiously I saw this bird frequently in 1937, but did not see it at all in 1938 though I often was at its former haunts.

Culicapa ceylonensis ceylonensis. Not recorded. S.A.

Frequently seen in Munnar and at Old Devicolam, 1,000 ft. higher up, and elsewhere in the hills, singly and in pairs in April and in May. J.B.P.

Tchitrea paradisi. Not recorded. S.A.

One bird in the chestnut plumage was seen near the High Range Club in the third week of April. Probably it had come up through the Pullivassal Gap. Residents say that the Paradise Flycatcher is seen, but rarely, in all plumages. Probably all are passage migrants. J.B.P.

LANIIDÆ.

Lanius schach caniceps. Not recorded. S.A.

Seen quite frequently in April and in May near Munnar and in the neighbourhood. One bird with a twig in its mouth was seen about the end of April. Noted at 6,400 ft. on May 17th and at 6,000 ft. on May 25th. J.B.P.

Lanius cristatus cristatus. S.A. and J.B.P.

Seen in much the same facies as caniceps, but not after the end of April. In April, the numbers of this shrike and the previous were fairly equal.

Hemipus picatus picatus. Not recorded. S.A.

Very commonly seen both in April and in May right up to the end. Parties numbering from 3 to 5 frequented the high trees, and went round the compound daily, several times in a regular route, sometimes with other small birds and sometimes with *Pericrocotus flammeus.* Their sweet notes were easily distinguishable whenever they appeared. J.B.P.

Pericrocotus flammeus. Not recorded. S.A.

Seen frequently in Munnar and in other parts of the district in April, and up to the end of May. J.B.P.

DICRURIDÆ.

Chaptia aenea malayensis. Not recorded. S.A.

I thought I saw it once in the Parsonage compound, but it may have been the common King Crow. It was dusk so I could not be certain. Others, however, have recorded *aenea* in these hills. J.B.P.

SYLVIIDÆ.

Acrocephalus dumetorum. Not seen. S.A. and J.B.P.

Phylloscopus nitidus. S.A. and J.B.P.

Either *nitidus* or *viridanus,* probably *viridanus,* was common in April and disappeared early in May. It was associated with *Cinnyris minima, Zosterops,* and sometimes with *Hemipus* in the daily tours of the garden trees. I watched the birds carefully for considerable periods, and came to the conclusion that *viridanus* was the subspecies, but they move so rapidly, and keep so well hidden that accurate observation is not easy.

There are other warblers to be seen on the grasslands in the dry parts of the district, but I could not achieve certainty in identification.

EULABETIDÆ.

Gracula religiosa indica. S.A. and J.B.P.

Several pairs were nesting when I arrived in Munnar in the second week of April. One pair had its nest in a hole in an acacia tree in the Parsonage compound about 25 ft. above ground. In another hole of the same tree, about 8 ft. above ground, a pair of Jungle Mynas were nesting at the same time. The Grackles held their nest up till the end of May.

STURNIDÆ.

Æthiopsar fuscus mahrattensis. S.A. and J.B.P.

Very common both in the High Range and in the Palnis as high as Kodaikanal. This is one of the species whose range appears to be extending with the increased areas of cultivation in the hills. A pair nested in the Parsonage compound as noted above.

FRINGILLIDÆ.

Carpodacus erythrinus roseatus. Not seen. S.A. and J.B.P.

HIRUNDINIDÆ.

Riparia concolor. Not recorded. S.A.

Seen at about 5,500 ft. near Periyakanal. Three young were seen on a rocky ledge in a cliff while the parent birds fed them on the wing. The young birds vibrated their wings and showed great excitement as the parents swooped near, and dropped food into their bills. This was on April 23rd. J.B.P.

Hirundo javanica domicola. Not recorded. S.A.

Seen frequently in and around Munnar. Common also in Kodaikanal. Young birds were been in a nest in the third week of April under the eaves of a bungalow in Munnar. J.B.P.

MOTACILLIDÆ.

Motacilla maderaspatensis. S.A. and J.B.P.

Common in Munnar and beside the larger streams. One young bird with ashy brown back was seen feeding near the Pullivassal Power House on 14th May.

Motacilla cinereas caspica. S.A. and J.B.P.

Common in April, but wholly absent in May. The last was seen on April 29th.

Motacilla flava simillima. Not recorded. S.A.

One flock of over 30 birds was seen in the river bank in Munnar Golf Course on April 12th. They were not seen again. Probably they had come up through the Pullivassal Gap, and were resting preparatory to their flight north. J.B.P.

Anthus hodgsoni hodgsoni Not recorded. S.A.

Seen once or twice in April in the Parsonage compound. Probably on migration. J.B.P.

Anthus rufulus malayensis. S.A. and J.B.P.

Seen on the grasslands above Munnar.

ALAUDIDÆ.

Alauda gulgula australis. Not recorded. S.A.

Seen often on the grasslands above Munnar. J.B.P.

ZOSTEROPIDÆ.

Zosterops palpebrosa nilghiriensis. S.A. and J.B.P.

Common in gardens and in sholas. Usually associated with the Small Sunbird and the Greenish Willow Warbler in the daily rounds. In probing the flowers of the Japanese Lantern, the bill is inserted, not into the cup, but from outside between the calyx and the petals. The Red-whiskered Bulbul does this also; why? The numbers in May diminished towards the end of the month but some were always present.

NECTARINIDÆ.

Cinnyris minima. Not recorded. S.A.

Common in Munnar and in the sholas up to over 6,000 ft. Seen both in full plumage and in eclipse plumage. In May only eclipse plumage was seen. J.B.P.

Arachnothera longirostra longirostra. Not recorded. S.A.

Not seen, but reported by other observers from Periyakanal (5,000 ft.) in September. J.B.P.

DICAEIDÆ.

Dicaeum concolor concolor. Not recorded. S.A.

Not seen. This seems very surprising. The bird is very common in Kodaikanal, 2,000 ft. higher than Munnar, and the trees and bushes on which it feeds are found in Munnar. It is recorded from Sānthanpāra, about 18 miles S.E. from Munnar, and 1500 ft. lower. I looked for it often, but never observed it. J.B.P.

PITTIDÆ.

Pitta brachyura. S.A.

Not seen, though I thought I heard one in a shola below Lockhart Gap on April 23rd. Residents say that this bird is only occasionally seen on some of the estates near Munnar in the cold weather. J.B.P.

PICIDÆ.

Picus xanthopygæus. Not recorded. S.A.

Seen at Munnar and up to 6,000 ft. and over. It is not common. A pair frequented the Parsonage compound in April and May. They feed on the same trees as a pair of Malherbe's Golden-backed Woodpeckers but not at the same times. J.B.P.

Chrysocolaptes guttacristatus chersonesus. S.A. and J.B.P.

Fairly common in April and May in and around Munnar. Their loud strident cry is often heard.

CAPITONIDÆ.

Thereiceryx viridis. Not recorded. S.A.

Fairly common in April and May, but heard and seen more often in April. A local migrant. I have heard it in May in the drier areas of the Kanan Devan Hills up to 6,000 ft. J.B.P.

CUCULIDÆ.

Centropus sinensis parroti. S.A. and J.B.P.

Common in Munnar and up to at least 6,000 ft. Their deep hoots are a feature of walks along the tea-estate roads. Met with both on grasslands and in shola.

PSITTACIDÆ.

Psittacula columboides. Not recorded. S.A.

Not seen in Munnar, but reported from Periyakanal (5,000 ft.). Many flocks seen at the Neriyamangalam Bridge (200 ft.) on the Alwaye-Munnar road. J.B.P.

ALCEDINIDÆ.

Halcyon smyrnensis fusca. S.A. and J.B..P.

Common on all the streams in and near Munnar, and seen on Devicolam Lake, ca. 6,000 ft. Said to nest in the banks of the lake.

UPUPIDÆ.

Upupa epops ceylonensis. S.A. and J.B.P.

Seen in April and May quite often. In Kodaikanal I have seen a nest in May.

CHAETURINÆ.

Chætura giganteus indicus. Not recorded. S.A.

This swift was seen several times in April and May in the Munnar valley. I do not think that it was there every day. There did not seem to be many of them, and I think that the few who were there ranged over a wide area.

I saw one or two other swifts, but was unable to identify them properly. One might have been a house swift, and another small and brownish, was fairly common. If it was the undernoted, I did not see a colony. J.B.P.

Collocalia fuciphaga unicolor. See S.A. on this bird.

I heard of a colony being found in a small cleft of a rock in these hills but did not see it myself. *N.B.,* vol. xxxix, no. 1, p. 29, 7 lines from top, for 'famous Pillar Rocks' should be read 'Travancore'.

BUBONINÆ.

Ketupa ceylonensis leschenauilt. Not seen. S.A. and J.B.P.

Several owls were seen all apparently of the same species, and the description agrees best with that of this owl. It has been reported from near Madupatty, and one was seen by me on the Perriavurrai estate ca. 5,500 ft. as well as lower down in and near Munnar. Residents say that this is the common owl of the district, and M. H. A. Ragg once shot an owl of this kind which was harrying the nest of a Malabar squirrel. J.B.P.

FALCONINÆ.

Falco tinnunculus objurgatus. Not recorded. S.A.

Seen in May over Munnar, and reported from near Madupatty. Common also on the Palnis up to over 7,000 ft. J.B.P.

Hieraaëtus fasciatus fasciatus. Not recorded. S.A.

One was seen on a tree in the Parsonage compound in April. For two or three hours on end it sat on the lower branch of a pine and repeated its shrill creaking call. After that day I did not certainly see it again. J.B.P.

Hæmatornis cheela melanotis. S.A. and J.B.P.

Seen occasionally in April and May flying high over Munnar. Identified by shrill triple whistle, though at times the whistle sounded only double.

Haliastur indus indus. Not recorded. S.A.

A pair was seen for some weeks over Munnar river. The birds departed about the middle of May, and re-appeared again towards the end of the month. J.B.P.

Milvus migrans govinda. S.A. and J.B.P.

One pair shared with the Brahminies the patrolling of the Munnar valley. They remained throughout April and May.

COLUMBINÆ.

Ducula badia cuprea Not recorded. S.A.

Seen twice; one bird ca. 5,500 ft. below the Lockhart Gap, and one flock of three on the Rajamally Ghat road about 6,000 ft. J.B.P.

Chalcophaps indica indica Not recorded. S.A.

Seen once feeding by the roadside at Devicolam, ca. 5,500 ft. J.B.P.

Though I did not see them, there appear to be other Green Pigeons in the Kanan Devan Hills. Of these the Southern Green Pigeon was probably one.

Columba livia. Not recorded. S.A.

A small flock was seen several times flying down the Munnar valley in the early morning, and returning in the evening. This was in April. Not seen in May. J.B.P.

Streptophilia chinensis suratensis. Noted as absent. S.A.

Very common in April and seen often in May up to the end of the month in Munnar and other places. One fed regularly on the lawn of the Parsonage garden. J.B.P.

PHASIANINÆ.

Gallus sonneratii. Not recorded. S.A.

Not seen, but reported by residents as being fairly common. J.B.P.

PERDICINÆ.

Galloperdix spadicea stewarti. Not recorded. S.A.

Not seen, but reported by residents as being occasionally seen. J.B.P.

Cryptoplectron erythrorhynchum. Not recorded. S.A.

A covey of about 6 birds was once seen. Residents say it is fairly common. J.B.P.

TRINGINÆ.

Tringa ochropus. Not seen. S.A. J.B.P.

Tringa hypoleucos. S.A. and J.B.P.

Seen, up to about the middle of May, on the Munnar river flowing through the Golf Course.

SCOLOPACINÆ.

Scolopax rusticola rusticola. Not recorded. S.A.

Mr. H. A. Ragg says that the Woodcock is still met with but very infrequently. The same remark applies to the following bird. J.B.P.

Capella nemoricola. Not recorded. S.A. Not seen. J.B.P.

Capella stenura. Not seen. S.A. and J.B.P.

ARDEIDÆ.

Ardeola grayii. Not recorded. S.A.

Seen often on the Munnar river and Golf Course in April, but not after the middle of May. J.B.P.

A PROPOSAL TO ADVANCE THE TEACHING AND RESEARCH IN ENTOMOLOGY IN INDIA.

BY

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(Opening remarks in a discussion of the Sections of Zoology and Entomology in the Silver Jubilee Session of the Indian Science Congress Association, Calcutta, 1938.)

The importance of entomology to agriculture, medicine, veterinary science and forestry is being felt more and more every day. It is increasing in view of the fact that in India alone the insects are responsible for an annual loss of about 200 crores of rupees. On account of the economic factor much attention has been devoted to this science during the last thirty years, and as a consequence it has made very rapid progress in some advanced countries of the world. It is, therefore, desirable that the teaching of entomology in our universities should be separated from that of zoology and be placed on a sound footing as in other countries like the United States of America and England. If possible, every university should be requested to have a separate department for the teaching of entomology with a course extending over four years. It should be given the same status as zoology and botany: for the B.Sc. classes it may be taken along with botany and zoology in those universities which teach three science subjects, but in those universities where only two science subjects are taken for the B.Sc. degree examination it may be combined with zoology so as to constitute one of the two papers in this subject.

The advantage of extending the course of entomology over four years and of teaching it along with zoology in the B.Sc. classes, is that a student will have a better grasp of the subject. After the first two years the B.Sc. students in entomology will be required to appear in two papers and a practical examination—the first paper being on general insect morphology, development and metamorphosis, and the second paper on taxonomy, classification and biology of insects. For the M.Sc. examination the entire subject can easily be distributed into five papers of 100 marks each, and a practical examination carrying 200 marks. The distribution of question papers will be as follows:—

Paper I.—Detailed insect morphology, physiology, development and metamorphosis.

Paper II.—Principles of taxonomy and classification with a detailed study of some representatives of each order.

Paper III.—Special aspects of insect biology, insect ecology and its relation to biological control.

Paper IV.—Principles of economic entomology in relation to agriculture, medicine, veterinary science and forestry; methods of insect control (mechanical, chemical and physical).

Paper V.—General principles of evolutionary biology (evolution, heredity, variation, cytology, distribution and palæontology) with special reference to insects.

Paper VI.—Practical.

The advantage of such a course is that it would give a student a thorough training in all aspects of entomology and zoology, and thereby equip him better for further research than the course hitherto followed can do. If, however, the universities find it impracticable to introduce entomology as one of the subjects for the B.Sc. classes, it may be exclusively taught in the M.Sc. classes, so that a student may have an opportunity of studying pure entomology for two years. This will give an opportunity to those students who pass the B.Sc. (Ag.) examination with entomology as an optional subject from agricultural colleges, to take the M.Sc. degree in entomology in the pure science faculty. It is, however, essential that an advanced student in entomology should have a good foundation in zoology, but if entomology is not separated from zoology, then there is a danger of entomology being ignored as is happening at present in the Indian universities.

So far the teaching of entomology has been confined to some agricultural colleges in our country, with a view to produce agricultural entomologists. Their outlook of entomology is very limited and they confine themselves to the knowledge of pests only. It is unfortunate that the universities in India have neglected the teaching of pure entomology, the importance of which has been rightly emphasized in some of the more progressive countries. In the United States of America, to quote Professor Faure (1933, p. 2) 'Most of the leaders in university teaching seem to be convinced that the best approach to entomology is through pure science rather than applied agriculture. They recognize that an entomologist sent out soon after graduation on extension work may find himself handicapped in gaining the confidence of the farmer if he lacks a knowledge of the farm practices obtaining in the locality, but they maintain that it is comparatively easy for a university graduate to acquire sufficient knowledge of agriculture for his purpose. On the other hand, most graduates in entomology are employed in research rather than in extension teaching, and it is essential for the research worker to have a good foundation in the basic sciences.

In some universities the department of entomology forms part of both the agriculture and pure science faculties, but the tendency seems to be to emphasize the science side rather than the agricultural side. An interesting feature of the work in several universities, such as Minnesota and Iowa State College, is the close association of zoology and entomology; in some cases both subjects are handled by the same department, in others the two departments work together in intimate coöperation to their mutual advantage.'

It is now fully recognised that for the purpose of achieving any success in applied work in entomology a mere knowledge of one branch of entomology is not enough, but a comprehensive understanding of entomology and other allied sciences is necessary, as nobody knows what particular line of attack on harmful insects will bear fruitful results. To waste time and money on those lines of attacks on insects, which in view of our previous knowledge of allied sciences would have been futile, is not a wise policy. In the past the training extending over a year or two given to students along with other subjects, left them extremely ill-equipped. They may be very good in one or two branches of entomology but their unfamiliarity with other allied branches has made them poor entomologists and consequently of little utilitarian value in solving the pressing insect problems of the country. The Indian Plague Commissioners working for seven years (1905-1912) in India failed, in spite of their efforts, to explain why certain large areas in India are comparatively free from plague and others having similar ecological conditions are not. The reason was found out by Hirst, who submitted a collection of fleas from two plague-free cities of Madras and Colombo to the late Hon'ble N. C. Rothschild. He determined these fleas to be different from *Xenopsylla cheopis*, which is the most efficient vector of plague bacilli, and they belonged to a new species *Xenopsylla astia* which later on was experimentally proved to be an inefficient vector of plague bacilli. Thus a pure systematic entomologist was able to solve a problem of great economic importance, which the applied entomologists with enormous funds at their disposal could not do within a period of seven years. Mis-identification of species have often hampered the work of applied entomologists.

The teaching of entomology has been separated from that of zoology in most of the important universities of England and America. In the universities of Cambridge, Oxford and London there are separate departments of entomology with separate teachers. In America, to quote Faure once again, 'In recent years there has been great expansion of entomological activities in the United States, with the result that the "old timer" who last visited the country in 1913 finds himself almost bewildered by the large departments and extensive developments encountered today. Universities that one had hardly heard about in entomological circles in 1913 now have four or five professors of entomology, and perhaps twenty or twenty-five post-graduate students, all actively engaged in research. And in general the growth in buildings and equipment seems to have kept pace with the growth in staff and in student numbers.' The problem of unemployment amongst university graduates in zoology in India can be solved to some extent by introducing entomology as a separate subject for post-graduate teaching in the universities. This will give an opportunity to unemployed graduates to do research in different aspects of entomology, which, if financed by the Imperial Council of Agricultural, Research and the Indian Research Fund Association, will go a long way to improve agriculture and the health of the people in India, and at the same time give opportunities for work to graduates trained in entomology. Rather than spend their time in idleness, the students will continue their studies in the hope that higher qualifications will improve their chances of getting work.

Another reason for the separation of entomology from zoology is that in some of the Indian universities the teachers of zoology having never done entomology as a special subject themselves, neglect entomology altogether, and hardly any lectures are delivered on entomology to the post-graduate students of zoology. Even insect-types which are prescribed for the under-graduates are either not taught or wrongly taught from old books on zoology in which old and wrong terminology is used. Taking the instance of the cockroach which is taught both in the Intermediate and B.Sc. classes, the frons in the head is wrongly described as the clypeus and the latter structure is described as the labrum in almost all the text-books on zoology. The description of the mosquito given in the text-books on zoology, which is also taught to the under-graduate classes is hopelessly inadequate and wrong; though excellent papers on the morphology of the mosquito were published as early as 1901 and 1902 by Nuttall and Shipley, and in 1907 and 1908 by Imms. Such an indifferent attitude taken by university teachers in zoology towards entomology and the stepmotherly treatment given to pure entomology by agricultural entomologists in our country cannot, I am afraid, further the cause of pure entomology; therefore we should adopt the same method of teaching which has been found useful in the advanced countries of Europe and America.

Pure entomology is a very progressive science and our concept of insect morphology and other branches of entomology has gone far ahead of that of zoology during the past thirty years, and the whole subject has become so vast that it demands an intensive study of its generalised principles extended over a period of at least two years. Without adequate fundamental knowledge of the pure science of entomology no tangible progress is possible in applied entomology.

The quality of research work, which usually suffers for lack of thorough acquaintance with the subject and modern research methods —and thorough acquaintance cannot be imparted in a year or so— will undoubtedly improve when the course of teaching entomology is extended over four years, or exclusively over two years, as suggested above.

Entomologists trained on the above-mentioned lines in the Indian universities, if given a chance to carry on their work for two years in any one of the institutions like the Imperial Agricultural Research Institute, New Delhi, Imperial Veterinary Research Institute, Muktesar, Forest Research Institute, Dehra Dun, Haffkine Institute, Parel, Bombay, or School of Tropical Medicine and Hygiene, Calcutta, can take the Ph.D. degree from their respective universities, and a certificate or diploma for advanced work in applied entomology from the institutes in which they would work. Such trained entomologists would be an asset to the country and would contribute a good deal to protect us against our insect enemies in our different walks of life.

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MEDICINAL AND POISONOUS PLANTS OF INDIA: *WATERLILIES, POPPYWORTS, FUMITORIES.*

BY

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I.

The Nymphaeaceæ are aquatic perennial herbs, with a submerged rhizome. Several members of this family were venerated by the ancients, not only for the magnificence of their flowers and leaves, carpeting the surface of the tranquil waters, but also on account of their utility. Their young rootstocks contain an abundance of starchy, mucilaginous, and sugary matters, which render them nutritive. The flowers, which have a peculiar scent like brandy, are narcotic. The seeds, filled with a floury albumen, are edible. The family consists of 8 genera and 50 species inhabiting the temperate and tropical regions of the globe.

The medicinal waterlilies of the world belong to 5 genera:— Brasenia (cosmopolitan, except in Europe); Euryale (south-eastern Asia); Nelumbo (Pennsylvania to Colombia; Asia and Australia); Nuphar (northern temperate and cold regions); Nymphaea (tropical and temperate regions). The genus Nuphar is not represented in India.

A. Sepals and petals 3 each. Carpels free. Ovules few ...	Brasenia.
B. Sepals 4-6; petals and stamens indefinite. Carpels confluent with one another or with the disk into one ovary; ovules many.	
1. Sepals, petals and stamens half-superior, inserted on the disk which is confluent with the carpels ...	Nymphaea.
2. Sepals, petals and stamens superior. Carpels sunk in the torus	Euryale.
C. Sepals 4-5; petals and stamens indefinite. Carpels irregularly scattered, sunk in pits of the turbinate disk ...	Nelumbo.

Nupharine, an amorphous physiologically inactive alkaloid of unknown constitution, has been isolated from the fresh rhizome of *Nuphar luteum* Sibth. & Sm. The seeds of this same plant contain nuphar-tannic acid. The amino-acid, l-asparagin, has been obtained from *Nelumbo nucifera* Gaertn.

Brasenia.

The only species, **B. Schreberi** J. F. Gmel., is cosmopolitan, except in Europe. In India it is to be found in Bhutan at an altitude of 6,000 feet, and in the Khasia Hills at 4,500 feet.

The leaves are astringent, and have been used in phthisis and dysentery in North America.

In Indo-China the stems and leaves are ground and applied to boils and abscesses. The seeds, in decoction form, allay thirst, neutralise the effects of certain poisons, strengthen the gums; they are considered cooling, digestive, and anti-dysenteric.

China: Ch'un, Shui K'uei, Shun—; *Indo-China*: Chuyen—; *Malaya*: Sooi kwai—; *North America*: Frog-leaf, Water-leaf, Water-lily, Water-shield, Water-target—.

EURYALE.

The only species, **E. ferox** Salisb., extends from Kashmir to Oudh and Eastern Bengal, and thence to China.

The seeds are much used for their tonic, astringent, and deobstruent properties.

In China an infusion of the seeds is used for ear-ache, and an infusion of the leaves is given after a painful delivery.

Bengal: Makhana—; *China*: Ch'ien Shih—; *English*: Foxnut—; *Hindi*: Machana, Makhana—; *Indo-China*: Ke dau, Khiem—; *Malaya*: Siew sat—; *Persian*: Mukareh, Mukhareh—; *Punjab*: Jewar—; *Sanskrit*: Makhanna, Padma—; *Telugu*: Mellunipadmanu—; *Urdu*: Makhana—; *Uriya*: Kunta-padma—.

NELUMBO.

The only Asiatic species, **N. nucifera** Gaertn. (=*Nelumbium speciosum* Willd.), extends from Persia eastwards to Australia, and is to be found throughout the warmer parts of India.

The plant is used medicinally all over the East. Nearly every part has a distinct name and economic use, and supplies one or more drugs.

The powdered *root* is prescribed for piles as a demulcent; also for dysentery and dyspepsia. It is used as a paste in ringworm and other cutaneous affections.

In Ceylon an aqueous extract of the fresh rootstock of the white-flowered variety is given internally in doses of 1 to 4 ounces for the bites of snakes and tarantulas. It is said to be especially useful in the bites of the cobra.

The flour of the root is used as an arrowroot by the Chinese. It is given in diarrhœa and dysentery; and it is the base of a diet for infants.

The long white rhizomes resemble a string of sausages, each about a foot long and separated from the others by a constricting fibre. These constricting fibres are used medicinally in China and are credited with the property of restoring to health persons suffering from nervous exhaustion. Their special action is regarded as hæmostatic.

The large *leaves* are used as cool bedsheets in high fever with heat and burning of the skin. The milky viscid juice of the leaf and flower stalks is given in diarrhœa.

The *flowers* are used as an astringent in diarrhœa, also cholera, in fever and diseases of the liver; and are also recommended as a cardiac tonic. Koman found that a syrup of the dried flowers in half ounce doses was efficacious in curing mild cases of dysentery.

In the Tamil country the flowers are considered diuretic and cooling. Boiled in milk with an equal amount of flowers of *Eugenia Jambolana* to a pasty consistence, and made into boluses about the size of an areca nut, they are administered to women for false pains in the early months of pregnancy.

The dried red petals are used by the Chinese as a cosmetic application to the face to improve the complexion.

The *stamens* are considered astringent and cooling, useful in burning sensation of the body, bleeding piles and menorrhagia. In bleeding piles they are administered with honey and fresh butter, or with sugar.

The carefully dried and yellow fragrant stamens are an astringent and diuretic remedy in China, where they are also used as a cosmetic. In Tongking they are employed for flavouring and improving the appearance of tea.

The *seeds* are used to check vomiting, and are given to children as a diuretic and refrigerant. They form a cooling medicine for cutaneous diseases and leprosy, and are considered an antidote for poisons.

In China the seeds, roasted and divested of their shells are a favourite article for dessert. Boiled and ground into flour the kernels form a valuable food and medicine, and are considered a general tonic recommended in diarrhœa, spermatorrhœa and erotic dreams.

The *plumule,* caulicle, or germinating embryo of the ripe seed is given in China to reduce high fever, and is said to be useful in the treatment of cholera, hæmoptysis and spermatorrhœa.

A sherbet of the plant is used as a refrigerant in small-pox, and is said to stop eruption; it is also used in all eruptive fevers.

Caius and Mhaskar have reported that no part of the plant is an antidote to either snake or scorpion venom.

Annam : Lien hoa, Sen—; *Arabic* : Karambe-ul-ma, Nilufer, Uss-ul-nilufer—; *Australia* : Aquaie, Pink Water-lily, Sacred Lotus—; *Bengal* : Kombol, Komol, Padama, Padma, Pudmapodu—; *Bijnor* : Besenda—; *Bombay* : Kamala, Kankadi—; *Burma* : Padung ma—; *Cambodia* : Chhuk—; *Canarese* : Kamala, Tavaribija, Tavarigadde—; *China* : Hoa Lien, Lien, Lien Jou, Lien Ou—; *Deccan* : Kungvel—; *English* : Chinese Water-lily, Egyptian Bean, Indian Lotus, Pythagorean Bean, Sacred Lotus—; *French* : Fève d' Egypte, Lis rose du Nil, Lotus sacré, Nénuphar de la Chine—; *Gujerati* : Suriyakamal—; *Hasada* : Kombolba, Upalba—; *Hindi* : Ambuj, Bhe, Kamal, Kanval, Kanwal Kakri, Kaul, Lalkamal, Padam, Padma—; *Ilocano* : Sucao—; *Khandesh* : Dudhamalidakand—; *Konkani* : Salloc—; *Malay* : Seroja, Teratai—; *Malayalam* : Bemtamara, Tamar—; *Marathi* : Kamal—; *Muzaffarnagar* : Pabbin—; *Persian* : Baklakoobtee, Beykhne-el-ufer, Nelofir, Nilufer, Nilufu—; *Poona* : Pandkanda—; *Pondicherry* : Nénuphar—; *Porebunder* : Motunkamal—; *Portuguese* : Flor de loto, Nenuphar—; *Punjab* : Bhen, Kanwalkakri, Pamposh, Pamposh kammal—; *Sanskrit* : Abja, Ambhoja, Ambhoruha, Ambuja, Ambujanma, Ambupadma, Amburoha, Amlana, Arvinda, Asyapatra, Bisakusuma, Bisaprasuna, Drishopadma, Harivetra, Indiralaya, Jalajanma, Kamala, Kawar, Kunja, Kusheshaya, Kutapa, Mahapadma, Mahotpala, Nala, Nalika, Nalina, Padma, Pankaja, Pankeruha, Pathoja, Pundarika, Pushkara, Putaka, Rajiva, Sahsrapatra, Sarojanma, Saroruha, Sarsija, Sarsiruha, Sharada, Sharapadma, Shatapatra, Shri, Shriparna, Shrivasa, Shuklapadma, Sitambuja, Sujala, Tumarasa, Vanashobhana, Varisoha—; *Sind* : Pabban—; *Sinhalese* : Nelumbo, Nelum—; *Tagalog* : Baino, Bayno—; *Tamil* : Ambal, Sivapputamarai, Tamarai—; *Telugu* : Kalung, Erratamara, Tamara—; *Urdu* : Nilufer—; *Uriya* : Padam—.

NYMPHAEA.

The genus consists of 40 tropical and temperate species.

Acrid, astringent, demulcent and diaphoretic properties are attributed to this genus.

The following species are used medicinally in Europe—*N. alba* Linn.—; in Egypt—*N. caerulea* Sav., *N. Lotus* Linn.—; in Nigeria, Sierra Leone, Senegal—*N. Lotus* Linn.—; in Guinea—*N. caerulea* Sav., *N. stellata* Willd.—; in Madagascar—*N. stellata* Willd.—; in China—*N. alba* Linn.—; in Indo-China—*N. alba* Linn., *N. stellata* Willd., *N. tetragona* Giorgi—; in North America—*N. alba* Linn., *N. polysepala* (Engelm.) Greene, *N. odorata* Ait.—.

Four species are used medicinally in India: *alba, pubescens, rubra, stellata.*

A.	Flowers white, about 5-11.2 cm. diam.	1. *N. alba.*
B.	Flowers red, pale rose or white, 7.5-20 cm. across ...	2. *N. rubra.*
C.	Like *rubra* but leaves more densely pubescent beneath. Flowers smaller, 7.5-10 cm. across	3. *N. pubescens.*
D.	Flowers usually pale violet, less commonly blue or purple, 7.5-15 cm. diam.	4. *N. stellata.*

1. **Nymphaea alba** Linn. occurs in Kashmir, Siberia and Europe.

The mucilaginous and somewhat acrid root and stock are administered in some countries for dysentery. It is an astringent and slightly narcotic medicine, which is reputed to have aphrodisiac properties. In some parts of England the juice is made into an ointment to stimulate the scalp so as to prevent falling out of the hair.

The flowers are reputed to be anti-aphrodisiac, and to have cooling and astringent properties. They are given in Persia for fevers and chest troubles.

An infusion of the flower and fruit is administered in diarrhœa, and as a diaphoretic.

Akwapim: Ntanowa—; *Annam*: Kien thiet—; *Arabic*: Nilufar—; *Bombay*: Pandharenkamal—; *Catalan*: Cadells, Escudet, Escut de riu, Ninifa, Platisgiradors—; *China*: Hung Pai, Lien Hua—; *Danish*: Soeblomster—; *Dutch*: Witte Zeebloem—; *English*: Flatter-dock, Lotus-lily, Nenuphar, Water-rose, White Water-lily—; *French*: Baratte, Blanc d'eau, Burette, Crugeon, Herbe aux plateaux, Lis d'eau, Lis d'étang, Lis des étangs, Lune d'eau, Lunette, d'eau, Nénuphar blanc, Grand nénuphar, Nymphe, Plateau à fleurs blanches, Pyrote, Volant d'eau, Volet, Volet blanc—; *Ga*: Tertermantrer—; *German*: Wasser Lilie, Wasserrose, Weisse Seeblume, Weisse Seerose—; *Greek*: Nymphaia, Sidi—; *Hausa*: Bado—; *Hindi*: Nilofar—; *Indo-China*: Bach lien tu, Hat sen trang—; *Irish*: Duilleoghuidhebhaitighe—; *Italian*: Carfano, Nenufaro bianco, Ninfea, Papeo—; *Kashmir*: Brimposh, Kamud, Nilofar—; *North America*: White Pond Lily, White Water Lily—; *Persian*: Nilufar—; *Polish*: Grzybienie, Wodna lilia—; *Portuguese*: Niniphea branca—; *Punjab*: Kammian—; *Roumanian*: Plumiera alba, Plumuna alba, Pluta, Nufar alb, Titva de apa—; *Russian*: Kubishka, Wodanoi lelei—; *Spanish*: Escudete de rio, Higos de rio, Nenufar blanco, Ninfea blanca—; *Swedish*: Sjoebad—; *Teheran*: Nilafar—.

2. **Nymphaea rubra** Roxb. is common throughout India in the warmer parts.

The powdered rootstock is given in dyspepsia, diarrhœa and piles.

A decoction of the flowers is prescribed in palpitation of the heart.

The flower is much used by Ayurveda practitioners. They prescribe it to allay thirst, cough, and vomting. They use it as a cooling and antibilious medicine; as a blood purifier, a febrifuge, and an aphrodisiac.

Arabic: Nulufar—; *Bengal*: Buroruktokumbal, Chotasundi, Nal, Raktakambal, Saluk, Shaluk—; *Burma*: Kiyani, Kyahphyu—; *Canarese*: Bilitavarai, Nyadalehuvu—; *Deccan*: Alliphul—; *Gujerat*: Kanval, Nilophal—; *Hasada*: Kombolba, Upalba—; *Hindi*: Chotakanval, Kanval, Raktachandana—; *Malayalam*: Ampala—; *Marathi*: Lalakamal, Raktakamal—; *Orissa*: Dhabalakain, Rangkain—; *Persian*: Nilufar—; *Sanskrit*: Alagandha, Alipriya, Alohita, Alpapatra, Aravinda, Arunakamala, Bhadra, Charunalaka, Hallaka, Indivara, Kalharamu, Kamala, Kokanada, Krishnakanda, Kumuda, Kuvalaya, Nilotpala, Raktakairava, Raktakalhara, Raktakamala, Raktakumuda, Raktambhoja, Raktasandhyaka, Raktasaroruha, Raktavarija, Raktavarna, Raktotpala, Ravipriya, Rochana, Sandhyaka, Shonapadma, Somakhya—; *Sind*: Kuni, Puni—; *Sinhalese*: Olu, Otu—; *Tamil*: Allitamarai, Ambal—; *Telugu*: Allitamara, Errakaluva, Kalharamu, Koteka, Tellakalava—.

3. **Nymphaea pubescens** Willd. is found all over India in the warmer parts.

The powdered root is prescribed for piles as a demulcent; also for dysentery and dyspepsia.

The flowers are astringent and cardiotonic.

Bengal: Burro, Shaluk—; *Bombay*: Kummul—; *Hindi*: Bombhur, Kawal zutto—; *Madras*: Alli—: *Persian*: Nelofir—; *Sind*: Koonee—.

4. **Nymphaea stellata** Willd. inhabits the warmer parts of India, and extends to tropical Asia and Africa.

In India the plant is used in the same ways and for the same purposes as *N. rubra*. It is moreover much employed to stimulate and promote the growth of the hair.

In Indo-China the seeds are considered a powerful stomachic and restorative.

In Cambodia the maceration of the leaves is used as a lotion in eruptive fevers. In Madagascar the leaves are applied topically in erysipelas.

In Guinea the infusion of the roots and the stems is considered emollient and diuretic; it is taken against blennorrhagia and diseases of the urinary tract. A decoction of the flowers is considered narcotic and antiaphrodisiac.

Bengal: Chotashaluk, Nilpodma, Nilsaphala, Nilsapla, Sundhi—; *Bijnor*: Bambher—; *Bombay*: Upliakamal—; *Burma*: Kyanyu—; *Cambodia*: Pralit—; *Ceyon*: Niltelolu, Katutelolu, Sudatelolu—; *English*: Blue Water-lily—; *Gujerati*: Nilkamal—; *Hindi*: Bambher, Bhengt, Lilophal, Nilkamal, Nilophal, Nilpadma—; *Hova*: Betsimihilana, Tantama, Tsiazonafo, Voahirana—; *Imerina*: Voalefoka—; *Indo-China*: Cu sung nho, Khiem tuc—; *Jodhpur*: Be—; *Madras*: Karunaydel, Nilotpalam—; *Malay*: Ati-ati payah, Kelipoh, Teratai Kechil—; *Malayalam*: Sitambel—; *Malinke*: Kuludion, Kulukulu—; *Marathi*: Krishnakamal, Poyani—; *Porebunder*: Kalakamal, Kamal, Kumtan—; *Sakalave*: Tatamo—; *Sanskrit*: Asitotpala, Indiwar, Kandota, Kandotha, Kuvalaya, Mridutpala, Nilakamala, Nilaliya, Nilambujanma, Nilapadma, Nilapatra, Nilotpala, Nilpankaja, Nilpatraka, Saugandhika, Utpala, Utpalaka—; *Sinhalese*: Manel, Monch, Nilupul—; *South Africa*: Water-lily—; *Tagalog*: Lauas—; *Telugu*: Nitikulava—; *Uriya*: Subaikain—; *Zulu*: Izibo—.

II.

The PAPAVERACEÆ inhabit the temperate and subtropical regions of the northern hemisphere; but few are met with in the tropics or southern hemisphere. Some species are now dispersed over cultivated ground throughout the world. The family consists of 28 genera and 600 species—annual or perennial herbs, rarely shrubs or small trees.

The members of this Order have sedative, narcotic, stupefying, at times caustic and rubefacient, properties. The seeds are oleaginous, some emetic and cathartic.

The following substances are among the products isolated:—(1) *alkaloids*—α and β—allocryptopines, aporeidine, aporeine, berberine, chelerythrine, chelidonine, homochelidonine, codamine, codeine, cryptopine, dicentrine, glaucidine, glaucine, gnoscopine, lanthopine, laudanidine, laudanine, laudanosine, meconidine, morphine, pseudomorphine, narceine, narcotine, neopine, oxynarcotine, papaveramine, papaverine, protopapaverine, pseudopapaverine, protopine, rheadine, sanguinarine, thebaine, isothebaine, tritopine—: (2) *bitter substances*—chelidoxanthin, glaucopicrin, papaverosin—; (3) *acids*—erratic, fumaric, meconic, rhoeadinic, sulphuric thebolactic—; (4) *fixed oils*; (5) *dyes*; (6) *gums, resins, starch, mucilage*; (7) *neutral principles*—meconin, meconoisin, opionin—; (8) *glucose sugar*; (9) *cyanogenetic glucosides.*

The medicinal and poisonous poppyworts of the world belong to 10 genera:—ARGEMONE (tropical America); BOCCONIA (warm America; West Indies); CHELIDONIUM (Europe; Asia Minor); ESCHSCHOLZIA (Pacific North America); GLAUCIUM (Europe; Asia); HYPECOUM (Mediterranean; Central Asia); MECONOPSIS (northern temperate regions); PAPAVER (Europe, Asia, America, South Africa, Australia); ROMNEYA (California); SANGUINARIA (Atlantic North America).

The medicinal and poisonous poppies of India belong to four genera: ARGEMONE, HYPECOUM, MECONOPSIS, PAPAVER.

A. Capsule usually short, opening by short valves or pores
  1. Stigmas 4 or more, radiating on a sessile disk ... PAPAVER.
  2. Stigmas 4-6, radiating from the top of a depressed style ... ARGEMONE.
  3. Stigmas 4-6, decurrent on the top of the style ... MECONOPSIS.

B. Capsule slender, transversely septate within, breaking up into joints or longitudinally 2-valved ... ... HYPECOUM.

ARGEMONE.

The genus includes 12 species, natives of Tropical America.

A. alba Lestib. is used medicinally in North America, and *A. mexicana* Linn. is so used in every country where it is found growing.

Argemone mexicana Linn., indigenous in tropical America, was introduced in India where it has become naturalized, and where it may be found throughout up to an altitude of 5,000 feet.

Far from being treated as a foreigner the plant occupies a very honourable place in the Materia Medica of both Hindus and Mahommedans. Hakims and vaids are at one in their encomium of this valuable medicinal herb.

The root is an alterative. The Hausas in Nigeria use an infusion of it as a wash for drummers who have to sustain their vigour through an all-night play. Among the Yorubas the root is chiefly used as a children's remedy, as a wash, or worn as a charm, or by fumigation in holding the head over a steaming pot containing this along with other medicines; also as an infusion taken internally by a child who is fretful or frightened at night. Women too are given an infusion to drink at the commencement of the pains of parturition.

The use of the root is attended with benefit in some chronic cases of skin diseases. In La Reunion it is given as a decoction in blennorrhagia; and in French Guiana this same decoction is prescribed for vesicular calculus. In French Guinea the decoction is used as an eye-wash and lotion for inflammatory swellings; also as a mouth-wash for tooth-ache, and taken internally for gleet.

In Gold Coast the pulverised root mixed with onions and applied to the guinea-worm sore is said to be effective in extracting the worm.

In La Reunion and in French Guinea the stem is considered diuretic; a decoction of it is prescribed for vesicular calculus in French Guiana.

The Mandingos of the Gambia use an infusion of the leaves for coughs.

In French Guiana the flowers are considered narcotic. The honey made by bees which visit this flower is said by the Hausas to make men mad.

The latex has slight corrosive properties, and is applied to warts, chancres, etc.

The seeds are laxative, emetic, nauseant, expectorant and demulcent. They are useful in cough and catarrhal affections of the throat and pulmonary mucous membrane, and in pertussis and asthma. Though they do not appear to possess any anti-spasmodic property, they have a distinct control over asthma, apparently from their combined actions of nauseant, emetic, expectorant and demulcent. As their use is often accompanied by more or less vomiting and nausea, they are as a laxative medicine more suited to some pulmonary affections than to other diseases.

In Mexico the seeds are considered an antidote to snake venom. In French Guiana they are used as a cathartic and an emetic.

The smoke from the burning seeds is used in Delhi to relieve tooth-ache; it is also said to be useful in caries of the teeth.

The seeds yield on expression a fixed oil, which has long been in use amongst West India and West Africa practitioners as an aperient. Applied to herpetic and other forms of skin disease, it is reported to exercise a well-marked soothing influence. It is serviceable in some cases in which jalap, rhubarb and castor-oil are indicated, and also in some bronchial and catarrhal affections. In Delhi and in Sind the oil is applied to indolent ulcers and eruptions, also as an external application for headaches.

The yellow juice of this plant is used as a medicine for dropsy, jaundice, and cutaneous affections. It is also diuretic, relieves blisters, and heals excoriations and indolent ulcers. It is held in much esteem as a local application to indolent and ill-conditioned ulcers. It is also used as an external application to the eyelid in conjunctivitis. In the Konkan, the juice with milk is given in leprosy.

In Jodhpur the yellow juice is used in eye affections and rubbed on the body to relieve rheumatic pain. In the West Indies it is reported to be used as a substitute for ipecacuanha.

The seeds are not an antidote to snake venom (Mhaskar and Caius).

The alkaloids of *A. mexicana* have been correctly identified as berberine and protopine (A. C. Santos and P. Adkilen; *Journ. Am. Chem. Soc.*, July 1932).

Annam : Ca gai—; *Arabic* : Bagel—; *Ashanti* : Akusiribie, Kokosekiyatuduru—; *Bengal* : Baroshialkanta, Karikanta, Shialakontha, Shialkanta, Siakanta, Siyalkanta—; *Brazil* : Cardo santo—; *Burma* : Khyaa—; *Canarese* : Balurakkisa, Datturi, Datturi-gidda, Mulludaturi, Parangidatturi—; *Cape Peninsula* : Bathurst Burweed, Steekbossie—; *Chinese* : Lao Chou Li—; *Colombia* : Cardosanto—; *Deccan* : Bharamdandi, Daruri, Farangidhatura, Pila, Piladhatura—; *English* : Gamboge Thistle, Jamaica Yellow Thistle, Mexican Poppy, Prickly Poppy, Yellow Mexican Poppy—; *Falor* : Bidjor—; *French* : Chardon bénit des Antilles, Figuier infernal, Pavot épineux, Pavot massue, Pavot du Mexique, Tache de l'oeil—; *French Guiana* : Argémone—; *Fulani* : Nyie gilangeru—; *German* : Mexicanische Argemone, Stachelmohn—; *Gujerat* : Darudi—; *Hasada* : Rangainijanum—; *Hausa* : Hakorin kada, Ka ki ruwan Allah, Kamukamu, Kankama, Kankamarka ta bi ka, Kaya geiva, Kurar fatake, Ya ki ruwan Allah—; *Hindi* : Bharbhand, Biladhutura, Brahmadundi, Brahmi, Farangidhutura, Kutaila, Kutila, Satiyanashi, Shialkanta, Suchianas, Ujarkanta—; *Ilocano* : Cachumba, Chicalote, Casubangaso, Casubhangaso—; *Indo-China* : Lao thu lac—; *Jodhpur* : Sattiyanasi—; *Kano* : Kwarko, Kwarkoro, Wagiri—; *Kathiawar* : Darudi—; *Katsina* : Karanko, Kwarakko, Kwaranko—; *Kolami* : Karikanta, Siyalkanta—; *Konkani* : Firingidutro, Redonoxi—; *La Reunion* : Chardon—; *Malayalam* : Brahmadanti—; *Malinke* : Ba, Guame-moni—; *Mandingo* : Tombong suma—; *Marathi* : Daruri, Firangidhotra, Kantedhotra, Kontedhotra, Pinvaladhotra—; *Mexico* : Cardo santo, Chicalotl, Figo del inferno—; *Mundari* : Bakulajanum—; *North America* : Jamaica Yellow Thistle, Mexican Poppy, Mexican Prickly Poppy, Thorn Poppy, Yellow Poppy-thistle—; *North-West Africa* : Devil's Fig, Golden Thistle of Peru, Mexican Poppy, Prickly Poppy—; *North-Western Provinces* : Bharbhurwa, Kantela, Karwah—; *Oudh* : Karwah—; *Portuguese* : Figo do inferno—; *Punjab* : Bhatkateya, Bhatmil, Bherband, Kandiari, Katsi, Satyanasa, Sialkanta—; *Sanskrit* : Brahmadandi, Bramhi, Hemadugdha, Hemashikha, Hemavati, Hemavha, Kanchanakehiri, Kanchani, Karhini, Katuparni, Kshirini, Patuparni, Pitapushpa, Rukmini, Srigalakanta, Suvarna, Svarnadagdha, Svarna-Kshiri, Svarnavha, Tiktadugdha, Yavuchincha—; *Santali* : Gokulapanum—; *Sinaloa* : Cardo, Chicalote—; *Sokoto* : Boginahi—; *Spanish* : Adormidera espinosa, Cardo santo, Fico del inferno, Figo del inferno—; *Suto* : Nthswantsane, Sehlohlo-se-seholo—; *Tagalog* : Diluario, Duluario—; *Tamil* : Bramadandu, Bramarayakash, Kurukkum—; *Telugu* : Brahmadandi— *Twi* : Anansemmenyan—; *Urdu* : Baramdandi—; *Uriya* : Dengbejari, Kantakusham, Sarpuni—; *Wolof* : Homhom bu djiguen, Hompay bu djiguen—; *Yoruba* : Akawn-ekkun, Egunarigbo, Ekan-chun, Kada ka taba yaro—.

HYPECOUM.

The genus includes 18 species of the Mediterranean region, distributed to Western and Central Asia.

1. Exterior petals elliptico-rhomboid, entire. Lobes of leaves linear-awl-shaped ... ... *H. pendulum.*
2. Exterior petals trilobed. Lobes of leaves linear-lanceolate or lanceolate, acute, mostly entire ... ... *H. procumbens.*

1. **Hypecoum pendulum** Linn. is found in Waziristan and Baluchistan, and extends to the Mediterranean region and the south of Europe.

An extract is used as a cooling drink by the Waziris.

Waziri : Margaypal, Zirgulaki—.

2. **Hypecoum procumbens** Linn. occurs in Peshawar, Multan, the Salt Range, and Baluchistan. It spreads over Western Asia as far as the Mediterranean region.

The juice has the same effect as opium. The leaves act as diaphoretic.

In Bavaria the plant is used as a tonic, aperient, and suborific.

English : Horned Cumin—; *Italian* : Cornacchina de grani, Cornacchina verdemare—; *Malta* : Cornacchina, Karn il Moghza—.

MECONOPSIS.

The genus includes 30 species of the northern temperate region.

1. Radical leaves linear-oblong or lanceolate, remotely and irregularly pinnatifid-lobed ... ... 1. *M. aculeata.*
2. Radical leaves pinnatipartite ... ... 2. *M. napaulensis.*

I. **Meconopsis aculeata** Royle occurs in Kashmir, Garhwal and Kumaon ascending up to 11,000-15,000 feet.

The plant, especially the root, is considered narcotic and poisonous.

Jhelum : Guddikum—; *Kumaon* : Kanda—; *Ravi* : Gudi—; *Simla* : Kanta—; *Sutlej* : Kanada—.

2. **Meconopsis napaulensis** DC. is found at 9,000-10,000 feet in Nepal, Sikkim and Bhutan, whence it extends to Sze-chuan.

The root is used as a narcotic.

PAPAVER.

The genus numbers 110 species scattered over Europe, Asia, Australia, America, and South Africa.

The flowers and flower heads are sedative; the milky juice is narcotic, sometimes caustic. Every species of poppy yields opium to a greater or less extent.

The following are used medicinally:—in Europe—*P. alpinum* Linn., *P. Argemone* Linn., *P. dubium* Linn., *P. hybridum* Linn., *P. somniferum* Linn.—; in Indo China—*P. somniferum* Linn.

A. Leaves 5-10 cm., all radical, obovate or oblong, pinnatifid. Flowers orange-yellow. Capsule obovoid, hispid. 7. *P. nudicaule.*

B. Leaves 2-3-pinnatifid. Flowers 2.5-5 cm. diam., scarlet with a black disk. Capsule 13 mm. long, subglobose, hispid. Stigma convex, rays 4-8 ... ... 4. *P. hybridum.*

C. Leaves 1-2-pinnatifid. Flowers 7.5-10 cm. diam., scarlet; pairs of petals unequal. Capsule stalked. Stigma convex, rays 8-12 ... ... 1. *P. Rhoeas.*

D. Leaves 1-2-pinnatifid. Petals scarlet in unequal pairs. Capsule obovoid, glabrous, sessile. Stigma 6-12-rayed ... 2. *P. dubium*

E. Leaves oblong, amplexicaul, lobed, 2-serrate. Flower large, white, purple or scarlet. Capsule 2.5 cm. diam., stalked, globose, glabrous. Stigmatic rays 5-12 ... 5. *P. somniferum.*

F. Leaves bipinnatisect with acute lobes. Petals pale scarlet. Capsule oblong-elliptical, sparingly beset with weak straight bristles ... ... 3. *P. Argemone.*

G. Leaves subcoriaceous, hispid on both sides, pinnatipartite. Flowers large, more than 10 cm. across. Petals 4-6, all scarlet or at the base with a black violaceous spot. Capsule glabrous, glaucous, subglobose, about 2-3 cm. diam. Stigmatic rays 13-15 ... ... 6. *P. orientale.*

1. **Papaver Rhoeas** Linn. is grown in gardens in Gujerat and Northern India. It is common in Kashmir, Tibet, Western Asia, Europe, and North Africa.

There is little to be found in Indian works about this poppy. Ayurvedists credit it with the same properties as *P. somniferum.* Yunanists use the leaves and seeds as tonics in low fevers, and recommend the cooked roots for rheumatism.

Quoth Culpeper of English fame: 'A syrup is made of the seed and flowers, which is useful to give sleep and rest to invalids, and to stay catarrhs and deflusions of rheums from the head into the stomach and lungs, which causes a continual cough, the forerunner of consumption; it helps hoarseness of the throat, and loss of voice, which the oil of the seed does likewise. The black seed boiled in wine, and drunk, stays the flux of the belly, and women's courses. The poppy-heads are usually boiled in water, and given to procure rest and sleep; so do the leaves in the same manner; if the head and temples be bathed with the warm decoction, or with the oil, the green leaves or heads bruised, and applied with a little vinegar, or made into a poultice with barley-water, or hog's-grease, cools and tempers all inflammations, and St. Anthony's fire. It is generally used in treacle and mithridate, and in all other medicines that are made to procure sleep and rest, and to ease pains in the head as well as in other parts. It cools inflammations, and agues. It is put in hollow teeth, to ease the pain; it is also good for the gout'.

Robert Turner says 'how excellent is that flower in diseases of the pleurisic with similar surfeits hath been sufficiently experienced'. But Gerard writes: 'most men being led rather by false experiments than reason, commend the flower against the Pleurisic, giving to drink as soon as the pain comes, either the distilled water, or syrrup made by often infusing the leaves. And yet many times it happens, that the paine ceaseth by that meanes, though hardly sometimes'.

The petals are, no doubt, sudorific; and they have mild sedative properties.

The milk from the capsules has, in a weak form, the same properties as opium; it is used in France as a sedative.

In England the bruised leaves, if applied to a part which has been stung by a bee or a wasp, are said to give prompt relief.

A non-toxic alkaloid, rhoeadine, occurs in all parts of the plant.

Anglo-Saxon: Chebole, Chesebolle, Chybolle—; *Arabic*: Khashkhashulsuda, Nabatulkhashkhash—; *Bengal*: Lalposht—; *Bombay*: Janglimudrika—; *Burma*:

Bhainbinami, Bhinbinami—; *Canarese*: Kempugasgase, Kempukhasakhasi—; *Catalan*: Caputxins, Gallarets, Paparotes, Parama, Pipiripip, Quicaraguichs, Quiquiriquic, Roellas, Rosella, Ruella—; *Chinese*: Li Ch'un Ts'ao—; *Deccan*: Lalkhaskhas—; *Dutch*: Heul Klaproos, Kankerbloem, Kolbloem, Roode Koorenbloem, Wilde Heul Klaproos—; *Egypt*: Qarun, Zaghlil—; *English*: Bledewort, Blind Eyes, Blindy Buff, Blindy-buffs, Canker, Canker Rose, Cheesebowl, Cockrose, Cock's-comb, Collin-hood, Copper-rose, Cop Rose, Corn Flower, Corn Poppy, Corn Rose, Cuprose, Cusk Darnel, Ear-aches, Fireflout, Head Ache, Head Poppy, Head Wark, Joan Silverpin, Lightnings, Maws, Poison Poppy, Pope, Red Weed, Ridweed, Scarlet Poppy, Soldiers, Thunder Bolts, Yedwark—; *French*: Babiot, Babiou, Babot, Babou, Cornrose, Confanon, Coprose, Coq, Coq ponceau, Coquelicot, Coquelicot-pavot, Gravelotte, Gueringuingo, Mahon, Moine, Onder, Pavot coq, Pavot-coquelicot, Pavot des champs, Pavot rouge des champs, Pavot rouge sauvage, Ponceau, Rose de loup—; *German*: Ackerschnalle, Blatsblume, Blutmohn, Boschblume, Fallblume, Feldmangenblume, Feldmohn, Feldrose, Feuerblume, Feuermohn, Flattermohn, Flitschrose, Gaublume, Glatschen, Glatzenblume, Glitsche, Grimmagblume, Haferkrautblaum, Halsrose, Hirnschalblume, Hirnschnalz, Jammerblume, Juffer, Klapperrose, Klatschmohn, Klatschrose, Kohlrose, Kokeschblume, Koklico, Koleblume, Kornmohn, Rote Kornrose, Maagsamen, Makufken, Wilder Mohn, Paterblume, Pflappenrose, Pugerlitze, Schnallen, Schnellerblume, Windmohn—; *Greek*: Roias—; *Gujerat*: Lala, Lalkhaskhas—; *Hindi*: Lal, Lala, Lalpost, Post, Postekebija—; *Hungarian*: Mak—; *Italian*: Bambagella, Bubboline, Citole, Papavero selvatico, Papavero serchione, Rosolaccio, Scitole—; *Languedoc*: Graousella, Graouselle, Roalo, Rouzello—; *Malayalam*: Chovannakashakasha—; *Malta*: Corn Poppy, Poppy, Papavero, Rosolaccio, Pepprin—; *Marathi*: Tambadakhasakhasa—; *Persian*: Gulelalakebija, Khashkhashsiyah, Koknaresurkh—; *Polish*: Maczek—; *Portuguese*: Papoila, Papoila vermelha, Papoula—; *Roumanian*: Mac iepuresc, Mac rosiu, Paparoane, Paparuna—; *Russian*: Mak samosyika—; *Sanskrit*: Raktapostavrikshaha—; *Spanish*: Ababol, Adormidera silvestre, Amapola, Arabol—; *Tamil*: Siguppuppostaka, Sivappugashagasha—; *Telugu*: Erragassagassala, Errapostakaya—; *Turkish*: Gelincik—; *Urdu*: Gulelalakenija, Khashkhashsiyah—; *Waziri*: Kolejhdarai, Zirdgul—.

2. **Papaver dubium** Linn. is found in the Western Himalaya from Hazara to Kashmir and Garhwal. It extends to Afghanistan, Western Asia, Europe and North Africa.

The petals are sudorific.

Two alkaloids, aporeine and aporeidine, have been isolated from this plant. The former is described as a tetanising poison similar to thebaine.

English: Pale-red Poppy, Smooth long-headed Poppy—; *Malta*: Long-headed Poppy—; *Portuguese*: Dormideira, Papoula—.

3. **Papaver Argemone** Linn. is indigenous in Europe in the Mediterranean region. It is cultivated in Indian gardens.

In Spain an infusion or a syrup of the petals is much esteemed as a sudorific.

English: Rough-headed Poppy, Rough long-headed Poppy—.

4. **Papaver hybridum** Linn. occurs in the Punjab in the Jhelum Valley. It is distributed over Central and Western Asia, Europe, and North Africa.

The petals are diaphoretic.

The species contains the non-toxic alkaloid rhoeadine and another base.

Egypt: Abunnom, Aul el num—; *English*: Rough-headed Poppy, Rough round-headed Poppy—; *Malta*: Rough Poppy, Pepprin—.

5. **Papaver somniferum** Linn. is cultivated in the warm and temperate regions of Asia, Europe and North Africa. It is doubtful whether the plant has ever been found wild. In India it is grown here and there throughout the country. In France a form is specially grown on account of its oil-yielding seed.

Opium, the inspissated juice obtained by incision from the immature capsule, is well known for its therapeutic and poisonous properties, and is official in all Pharmacopoeias.

The seeds are used medicinally in Jodhpur, and the capsules are soaked in water which, after being strained, is taken as an intoxicant.

In Indo-China the roasted seeds are considered tonic.

Poppy heads are used in China for diarrhoea, dysentery, and all kinds of fluxes. The seeds ground in cold water are given in diarrhoea and dysentery.

A weak decoction of the dried capsule is good for those complaints which require sedatives, and native practitioners in India administer it as a restrainer in bowel troubles. In Europe, however, the decoction is not given internally, but is employed as an external application to allay pain and soothe.

In Europe syrup of poppy is still often employed to allay cough and likewise as an opiate for children. This syrup is prepared from the capsules. Another syrup, made of the leaves and flowers, is also used in pleurisy and erisypelas.

The green leaves, the fresh flowers, the crushed capsules are all made into various ointments, or used as such for poulticing.

Opium, in combination with other drugs, is recommended for the treatment of snake bite and scropion sting. Caius and Mhaskar have proved experimentally that the drug is not an antidote to snake venom, and is useless in the treatment of scorpion sting.

Arabic : Abunom, Afiun, Bizrulkhashkhash, Khashkhashulbaiza, Khish khash, Qishrulkhashkhash— ; *Bengal* : Pasto, Post— ; *Bombay* : Aphim, Appo, Khaskhas, Post— ; *Burma* : Bhain, Bhainzi— ; *Canarese* : Afim, Biligasgase, Gasagase, Khasakhasi— ; *Catalan* : Cascall Pintacogues— ; *Chinese* : Ying Tzu Su— ; *Danish* : Valmue— ; *Deccan* : Afim, Khashkhash— ; *Dutch* : Heul, Slaapruid— ; *Egypt* : Abun-nom, Shikh-shakh— ; *English* : Bale-wort, Carnation Poppy, Joan Silverpin, Opium Poppy, Peony Poppy, White Garden-poppy, White Poppy— ; *French* : Pavot, Pavot blanc, Pavot des jardins, Pavot à opium, Pavot somnifère— ; *German* : Mohn, Saatmohn, Schlafmohn— ; *Greek* : Agria, Milkon hymeros— ; *Gujerat* : Aphina, Khuskhus, Posta— ; *Hamadan* : Khash-khash— ; *Hindi* : Afin, Afyun, Kashkash, Pest, Post, Potekebija— ; *Indo-China* : A phien, A phu dung, Co tu tuc— ; *Italian* : Papavero, Papavero domestico— ; *Kachhi* : Doda, Post— ; *Kumaon* : Posht— ; *Malaya* : Bungapion, Yin soo hock— ; *Malayalam* : Afiun, Kashakasha— ; *Malta* : Opium Poppy, Poppy, Papavero, Pianta da oppio, Papavru, Xahxieh— ; *Marathi* : Aphu, Khuskhus, Posta— ; *Nepal* : Aphim— ; *Oudh* : Posta— ; *Persian* : Afiun, Khashkhash, Khashkhashsufaid, Koknar, Postekoknar, Tukhmekoknar— ; *Portuguese* : Dormideira, Papoula branca— ; *Punjab* : Afim, Doda, Khashkhash, Khishkhash, Post— ; *Roumanian* : Mac, Mac somnisor, Somnisor— ; *Russia* : Mak snotvornyi— ; *Sanskrit* : Ahifen, Chosa, Khasa, Khakasa, Ullasata— ; *Sinhalese* : Abin, Albinatta— ; *Spanish* : Adormidera, Dormidera— ; *Swedish* : Vallmo— ; *Tamil* : Abini, Gashagasha, Kasakasa, Postaka— ; *Telugu* : Abhini, Gasagasala, Gasalu, Kasakasa— ; *Turkish* : Hashash— ; *Urdu* : Khashkhashsufaid— ; *Uruguay* : Adormidera, Amapola— ; *Waziri* : Afin, Kolijhdarai—,

6. **Papaver orientale** Linn. is cultivated in Indian gardens. It is common in North Persia, Armenia, and the Mediterranean region.

The petals are sudorific.

A series of alkaloids have been isolated from the plant : thebaine, isothebaine, glaucidine, two phenolic bases, and one nonphenolic base.

7. **Papaver nudicaule** Linn. is found in the Northern Himalaya, up to an altitude of 17,000 feet. It extends through Afghanistan to Northern Asia and to Central and Northern Europe.

The flowers and capsules are mildly diaphoretic.

Waziri : Kakavai—.

III.

The FUMARIACEÆ are often considered as a sub-family or a tribe of the Papaveraceae. They are annual or perennial herbs broadly distributed in temperate and warm regions, mainly in the temperate zone of the northern hemisphere. The family includes 7 genera and about 260 species.

Most fumitories contain in their herbaceous parts mucilage, saline substances, and a peculiar acid or acrid juice, so combined that they are classed among tonic and alterative medicines.

The following have been isolated from members of the Order:—(1) *alkaloids*—bulbocapnine, corybulbine, isocorybulbine, corycavamine, corycavidine, corycavine, corydaline, dehydrocorydaline, corydine, corypalmine, corytuberine, dicentrine, fumarine, protopine, sanguinarine, d-tetrahydropalmatine—; (2) *acids*—fumaric.

The medicinal fumitories belong to three genera: CORYDALIS (Mediterranean region, Europe, Asia); DICENTRA (Asia, North America); FUMARIA (Europe, Asia, Africa; chiefly Mediterranean).

No Indian DICENTRA is credited with therapeutic properties.

1. One outer petal spurred ; capsule many-seeded ... CORYDALIS.
2. One outer petal spurred ; fruit indehiscent, nut 1-seeded. FUMARIA.

CORYDALIS.

The genus numbers about 140 species, natives of the Mediterranean region, inhabiting Europe and Asia.

The genus is tonic, diuretic, and alterative. The roots are used as emmenagogues and vermifuges.

The following species are employed medicinally in Europe—*C. bulbosa* Pers., *C. claviculata* Pers., *C. fabacea* Pers., *C. lutea* DC., *C. ochroleuca* Koch. ; in China—*C. ambigua* Cham. and Sch., *C. incisa* Pers.—; in Indo-China—*C. bulbosa* Pers.—.

Some twenty alkaloids have been isolated from various Corydalis roots.

1. Stems erect. Flowers 2.5 cm. long ... ... 1. *C. Govaniana.*
2. Stems procumbent. Flowers 12 mm. long ... ... 2. *C. ramosa.*

1. **Corydalis Govaniana** Wall. is found in Western Himalaya from Kashmir to Kumaon at 8,000-12,000 feet.

The root is considered tonic, diuretic, alterative, and antiperiodic. It is prescribed in syphilitic, scrofulous, and cutaneous affections.

Bengal : Bhutkesi, Bhutkis—; *Hindi* : Bhutkesi, Bhutkis—; *Punjab* : Bhutkes, Bhutkis—; *Sanskrit* : Bhutakesi—.

2. **Corydalis ramosa** Wall. inhabits the temperate portion of the Himalaya from Kashmir to Sikkim, at 12,000-15,000 feet.

In the Kurram Valley the plant is, like all other plants with yellow sap, employed in the treatment of eye diseases.

Kurram Valley : Mamiran—.

FUMARIA.

This genus includes 46 species, natives of the Mediterranean region, and distributed over Central Europe, Asia, Africa; one being almost cosmopolitan.

The genus is tonic, aperient, and resolvent.

The following are used medicinally in Europe: *F. capreolata* Linn., *F. densiflora* D.C., *F. media* Lois., *F. officinalis* Linn., *F. parviflora* Lam., *F. Schleicheri* Soyer-Willem., *F. spicata* Linn., *F. Vaillantii* Lois.—; in Indo-China—*F. officinalis* Linn., *F. parviflora* Lam.—.

1. Flowers pink with wings of upper petal reflexed upwards, bracts about as long as the pedicel or longer. Flowers purplish pink with wings of upper petal at most obscurely purple. Fruit of moderate size, subtruncate, rarely apiculate ... ... 1. *F. indica.*
2. Flowers white, sometimes flushed with pink, with erect spreading, patent or reflexed wings to the broad upper petal; sepals usually present; outer petals not emarginate; the wings of the upper usually with a purple blotch. Fruit often subacute, rugose ... ... 2. *F. parviflora.*

1. **Fumaria indica** Pugsley is distributed over the greater part of India up to 8,000 feet on the Himalaya. It extends through Baluchistan and Afghanistan to Persia, Turkestan, Songaria and Mongolia.

The plant is diuretic, diaphoretic, and aperient.

An extract is drunk by the Waziris for the purpose of cooling the body, and it is also applied externally for the same purpose.

Waziristan : Lavang, Levanai, Margyapal, Parparie, Sevae—.

2. **Fumaria parviflora** Lam. is found in Baluchistan, the Taurus, and Persia.

The herb is highly esteemed by the Mahommedans in India; it is said to purify the blood and act as a laxative and diuretic. In Persia it is often mixed with chicory for medicinal purposes.

The dried plant is regarded as efficacious in low fever, and is also used as an anthelmintic, diuretic, diaphoretic and aperient, and to purify the blood in skin diseases.

Along with black pepper, it is used in the treatment of ague.

It is used in Europe as an alterative, aperient, and antifebrile drug. It is given in Spain in visceral obstructions, in scorbutic affections, and in various eruptive diseases.

Decoctions of the entire plant were given to cases of mild pyrexia and the result was unsatisfactory (Koman).

The plant contains fumaric acid and the alkaloid fumarine.

Arabic: Baglat-ul-mulk, Bukslat-ul-mulik, Rizud-dejaj, Shahatraja, Shatraraj—; *Baluchi*: Kahurkah, Kankechk—; *Bengal*: Bansulpha, Shulpha—; *Bombay*: Pitpatra—; *Deccan*: Pitpapara, Shatra—; *Egypt*: Shahtarag, Shatreyg—; *English*: Fine-leaved Fumitory, Small-flowered Fumitory—; *Gujerat*: Khasudlio, Pitpapda, Pittapapado—; *Hamadan*: Shahtara—; *Harboi Hills*: Kafutkawa—; *Hindi*: Banshulpha, Pitpapada, Pitpapara, Pitpapra, Shahatra—; *Indo-China*: Tug sha tu chinh—; *Kumaon*: Khairuwa—; *Marathi*: Pitpapda—; *Persian*: Shahatra, Shah-tarra, Shatra—; *Punjabi*: Pitpapra—; *Pushtu*: Papra, Pitpapra, Shahtara—; *Quetta-Pishin*: Shatara—; *Sanskrit*: Araka, Charaka, Kalapanga, Katupatra, Kavachanamaka, Krishnashakha, Ksheparpata, Nakra, Panshu, Panshuparyaya, Parpata, Parpataka, Pragandha, Pittari, Renu, Shita, Shitavallabha, Sutikta, Tikta, Trishnari, Triyashti, Varatikta, Varmakantaka—; *Sind*: Shahatra, Shatra—; *Tamil*: Tusa—; *Teheran*: Shahtara—; *Telugu*: Chatarasi—; *Urdu*: Shahatra—; *Waziri*: Lavang—.

PLANTS OF KUWAIT, NORTH EAST ARABIA.

BY

MRS. V. DICKSON.

The following is a list of wild flowers of Kuwait State, (N.E. Arabia Dist. IV) including the islands of Failaka (pr. loc. Failicha) and Masjan, together with a few notes on the edible and medicinally used plants and shrubs.

I have collected specimens over a period of nine years, since 1929, and all these have been identified by the late Mr. Horwood, and determinations sent to me by Sir Arthur Hill of the Royal Botanic Gardens, Kew, London.

This list will be found much more complete than the one in *Records of the Botanical Survey of India*, vol. vi, no. 6; by Humphrey G. Carter, M.B., Ch.B. with notes by Sir Percy Cox, K.C.S.I., K.C.I.E. and Lt.-Col. S. G. Knox, C.I.E., which is as far as I know the only publication (excluding Blatter?) on flowers of Kuwait. Some plants mentioned by Carter such as Oleander do not grow wild in Kuwait, and were possibly found growing in gardens.

There is still one plant which has not yet been identified for me by Kew: a Cruciferae which appears to be a new species, and is probably referred to in the above publication as *Erucaria* Boiss.

My husband, Lt.-Col. H. R. P. Dickson, C.I.E., has been Political Agent in Kuwait from 1929-1936, and is now in the Kuwait Oil Company, so I have had great opportunities to collect flowers, as we have had a permanent camp each spring out with the Badawin in the desert some 50 to 100 miles in the interior. We were both of us also fortunate to visit His Majesty King Bin Saud last November in his capital Riyadh. The names of the flowers collected on this trip will be found at the end of this list.

The plants listed below were collected by me between the years 1933-1938.

PAPAVERACEÆ.

Hypecoum pendulum L.
Papaver Rhoeas L.
,, *Rhoeas* L. var. *subintegrum* Willk.
,, *somniferum* L.
,, *somniferum* L. var. *leplocanlolum* Fedde.
Roemaria hybrida DC.

CRUCIFERÆ.

Brassica Tournefortii Gouan.
Carrichtera annua Asch.
Diplotaxis Harra (Forsk.) Boiss.
,, *acris* (Boiss.)
Eruca sativa Lam. var. *eriocarpa*.

Erucaria aleppica Gaertn.
Farsetia aegyptia Turra
Fibigia longisiliqua Dcne.
Lepidium sativum L.
,, *ruderale* L.
,, *Aucheri* Boiss.
Leptaleum filiforme DC.
Malcolmia africana (L.) R. Br.
,, *assyriaca* Hausskn. et Bornm.
,, *pulchella* Boiss. var. *pygmaea* R. Br.
,, *torulosa* (Desf.) Boiss. var. *leiscarpa* Boiss.
Matthiola bicornis DC.
,, *troida* DC.
Notoceras bicorna Cav.
Savignya oblonga Boiss.
,, *parviflora* (Del.) DC.
Schimpera arabica Boiss.
,, *persica* Boiss.
Sinapis (*Brassica*) *arvensis* L.
Sisymbrium cf. *erucastroides* Stapf.
Torularia torulosa (Desf.). O. E. Schultz.

RESEDACEÆ.

Ochradenus baccatus Del.
Oligomeris subulata (Del.) Boiss.
Reseda arabica Boiss.
,, *decursiva* Forsk.
,, *muricata* Presl.

CISTACEÆ.

Helianthemum ellipticum Pers.
,, *kahiricum* Del.
,, *ledifolium* Mill.
,, *Lippii* (L.) Pers.
,, *salicifolium* Mill.

FRANKENIACEÆ.

Frankenia pulverulenta L.

CARYOPHYLLACEÆ.

Ankyropetalum gypsophiloides Fenzl.
Gypsophila porrigens Boiss.
Loeflingia hispanica L.
Paronychia argentea L.
Polycarpaea repens (Forsk.) Asch. et Schwein.
Polycarpon tetraphyllum L.
Robbairea prostrata (Del.) Boiss.
Saponaria Vaccaria L.
Silene conoidea L.
,, *conica* L.
,, *leyseroides* Boiss. (calyx reticulate).
,, *villosa* Forsk.

TAMARICACEÆ.

Tamarix articulata Vahl
,, *macrocarpa* Bge.

MALVACEÆ.

Malva parviflora L.

ZYGOPHYLLACEÆ.

Fagonia Bruguieri DC.
,, *glutinosa* Del.
Nitraria tridentata Desf.
Seetzenia orientalis Dcne.
Tribulus terrestris L.
Zygophyllum coccineum L.

GERANIACEÆ.

Erodium ciconium Willd.
,, *cicutarium* L'Herit.
,, *glaucophyllum* Ait.
,, *laciniatum* Cav.
,, *triangulare* Musch.
,, *triangulare* Musch. var. *pulverulentum* Boiss.
Monsonia nivea J. Gay.

RUTACEÆ.

Haplophyllum tuberculatum (Forsk.) A. Juss.
Peganum Harmala L.

RHAMNACEÆ.

Zizyphus Spina-Christi Willd.
,, *Spina-Christi* Willd. var. *inermis* Boiss.

LEGUMINOSÆ.

Acacia Seyal Del.
Alhagi maurorum DC.
Astragalus annularis Forsk.
,, cf. *baeticus* L.
,, *bombycinus* Boiss.
,, *brachyceras* Led.
,, *corrugatus* Bent. ex DC.
,, *cruciatus* DC.
,, *dactylocarpus* Boiss.
,, *Forskahlei* Boiss.
,, *gyzensis* Del.
,, *peregrinus* Vahl
,, *Schimperi* Boiss.
,, *striatellus* Pall.
,, *tenuirugis* Boiss.
,, cf. *tribuloides* Del.
Hippocrephis cf. *bicontorta*.
,, *unisiliquosa* L.

Hymenocarpos nummularius Boiss.
Lotus pusillus Viv.
Medicago Aschersoniana Urb.
,, *laciniata* Willd.
Melilotus parviflora Desf. (*M. indica* L.)
Onobrychis ptolemaica DC.
Ononis serrata Forsk.
,, *reclinata* L.
Prosopis Stephaniana (Willd.) Spreng.
Scorpiurus muricatus L.
Trigonella anguina L.
,, *hamosa* L.
,, *stellata* Forsk.
,, cf. *maritima* Del.
Vicia peregrina L.

ROSACEÆ.

Neurada procumbens L.

CUCURBITACEÆ.

Citrullus Colocynthis (L.) Schrad.

FICOIDEÆ.

Aizoon canariense L.
,, *hispanicum* L.
Cryophyton (*Mesembryanthemum*) *nodiflorum* (L.) N.E. Br.

UMBELLIFERÆ.

Ammi majus L.
Anisosciadium lanatum Boiss.
,, *orientale* DC.
Bupleurum semicompositum L.
Cuminum cyminum L.
Pimpinella puberula Boiss.
Tordylium persicum Boiss. in Haussk.

RUBIACEÆ.

Crucianella membranacea Boiss. (*C. ciliata* Lam.)
Galium Decaisnei Boiss.
,, *sinaicum* Boiss.

DIPSACACEÆ.

Cephalaria syriaca (L.) Schrad.
Scabiosa Olivieri Coult.
,, *palaestina* L.
,, *palaestina* L. var. *calocephala* Boiss.

COMPOSITÆ.

Aaronsohnia Factorovskyi Wart. et Eig.
Acantholepis orientalis Less.
Anthemis deserti Boiss.

Anvillea Garcini DC.
Artemisia monosperma Del.
Atractylis cancellata L.
,, *flava* Desf.
Calendula aegyptica Desf.
,, *persica* C.A.M.
Carduus pycmocephalus Jacq. and var. *arabicus* (Jacq.) Boiss.
Carthamus oxyacantha M. Bieb.
,, *tinctorius* L. (cultivated).
Centaurea mesopotamica Bornm.
,, *phyllocephala* Boiss.
,, *solstitialis* L.
Crepis parviflora Desf.
Filago spathulata Presl. var. *prostrata* (Parl.) Boiss.
Ifloga spicata (Forsk). Sch. Bip.
Koelpinia linearis Pall.
Launaea arabica (Boiss.) Cass.
,, *mucronata* (Forsk.) Musch.
,, *nudicaulis* (Less.) Hook. f.
Leontodon hispidulum Boiss. var. *tenuilobum* Boiss.
Matricaria (*Chamomilla*) *aurea* (L.) J. Gay.
Odontospermum pygmalum B. et H.
Picris saharae Batt.
Reichardia tingitana (Desf.) Roth.
Rhanterium epapposum Oliv.
Senecio coronopifolius Desf.
Urospermum picroides L.

PLUMBAGINACEÆ.

Statice spicata (L.) Willd.
,, *thouini* Viv.
,, *suffruticosa* L.

PRIMULACEÆ.

Anagallis arvensis L. var. *carnea* Koch.
,, *femina* Mill.
,, *latifolia* L.

BORAGINACEÆ.

Anchusa aggregata Lehm.
Arnebia decumbens Coss. et Kral. (*A. cornuta* Led.) F. et M.
,, *tinctoria* Forsk.
,, *hispidissima* DC.
Gastrocotyle hispidia (Forsk.) Bge. and var. *songarica.*
Heliotropium undulatum Vahl
Lappula spinocarpos Aschers.
Lithospermum callosum Vahl and var. *asperrimum* Bornm.
,, *incrassatum* Guss.

CONVOLVULACEÆ.

Convolvulus aff. *lineatus* L.
,, *oxyphyllus* Boiss.

Convolvulus pilosellaefolius Desf.
,, *sp.* cf. *sericeus* Burm.
Cressa cretica L.
Cuscuta planiflora Ten.

SOLANACEÆ.

Hyoscyamus pusillus L.
Lycium arabicum Schweinf.
,, *barbarum* L.

SCROPHULARIACEÆ.

Antirrhinum Orontium L.
Linaria chalepensis (L.) Mill.
,, *micrantha* Cav.
,, *simplex* DC. var. *flaviflora* Boiss.
Scrophularia deserti Del.

OROBANCHACEÆ.

Cistanche tubulosa Schenk.
Orobanche aegyptiaca Pers.
,, *cernua* Loefl. var. *desertorum* Beck.

LABIATÆ.

Salvia aegyptiaca L.
,, *spinosa* L.
Teucrium Polium L. var. *lanuginosum* Celak.
,, *Oliverianum* Ging.

PLANTAGINACEÆ.

Plantago albicans L.
,, *amplexicaulis* Cav.
,, *ciliata* Desf.
,, *coronopus* L.
,, *cylindrica* Forsk.
,, *Lagopus* L.
,, *ovata* Forsk.
,, *Psyllium* L.

ILLECEBRACEÆ.

Herinaria cinerea DC.
,, *hemistemon* J. Gay.
Paronychia arabica DC.
Pteranthus dichotomus Forsk.

CHENOPODIACEÆ.

Anabasis articulata Forsk.
,, *setifera* Moq.
Arthrocnemum glaucum Ung.
Atriplex dimorphastegia Kar. et Ker.
,, *sp.* aff. *A. parviflora* Lowe.
,, *leucocladum* Boiss.

Bassia eriopora Schrad.
Beta maritima L.
Chenopodium album L.
,, *murale* L.
Cornulaca monacantha Del.
Echinopsilon muricatum (Schrad.) Moq.
Haloxylon salicornicum Bge.
Polycnemon sp.
Salsola hispidula Bge.
,, *Kali* L.
,, *longifolia* Forsk.
,, *verrucosa* MB.
Suaeda baccata Forsk.
,, *vermiculata* Forsk.

POLYGONACEÆ.

Calligonum comosum L'Hérit.
Emex spinosus Camped.
Polygonum Bellardi All.
Rumex pictus Forsk. var. *bipinnatus* (Lil.) Maire.
,, *vesicarius* L.

THYMELAEACEÆ.

Lygia Passerina L.
,, *pubescens* (Guss.) Boiss.

BALANOPHORACEÆ.

Cynomorum coccineum L.

EUPHORBIACEÆ.

Andrachne telephioides L.
Crozophora oblongifolia A. Juss. (*C. obliqua* Vahl) A. Juss.
Euphorbia cornuta Pers.
,, *sp.* cf. *E. hieroglyphica* DR.

ASCLEPIADACEÆ.

Calotropis procera R. Br.

VALERIANACEÆ.

Valerianella leiocarpa Koch. (*V. Dufresnei* Bge.).

FUMARIACEÆ.

Fumaria parviflora Lam.

CHARACEÆ.

Chara vulgaris L.

GENTIANACEÆ.

Centaurium (*Erythraea*) *ramosissimum* (Pers.) (sensu Fl. Orient.)

LINACEÆ.

Linum usitatissimum L.

JUNCACEÆ.

Juncus acutus L.

MONOCOTYLEDONS.

IRIDACEÆ.

Iris Sisyrinchium L.
Gladiolus segetum Ker.—Gawl.

LILIACEÆ.

Allium desertorum Forsk.
,, *laceratum* Boiss. et Noe
,, *sphaerocephalum* L. and var. *arvense* Parl.
Asphodelus tennifolius Cav.
Bellevalia flexuosa Boiss.
,, cf. *longipes* Post.
Dipcadi erythraeum Webb et Benth.
Gagea reticulata (Pall.) Schult. and var. *rigida* (Boiss. et Sprun.) Pasch.
Muscari comosum (L.) Mill.

AMARYLLIDACEÆ.

Ixiolirion montanum Herb.

CYPERACEÆ.

Cyperus conglomeratus Rottb. var. *arenarius* Coss.
,, *rotundus* L. (probably).
,, *arenarius* Retz. (cf. Auch no. 5483).

GRAMINEÆ.

Ammochloa palaestina Boiss.
Argilops triunciatis L.
Aristida ciliata Desf.
,, *obtusa* Del.
,, *plumosa* L.
Avena barbata L.
Bromus tectorum L.
Cenchrus ciliaris L.
Cutandia memphitica Batt. et Trab.
Cynodon Dactylon Pers.
Koeleria phleoides Pers.
Lolium rigidum Gaud.
Panicum turgidum Forsk.
Phragmites communis Trin.
Sphenopus divaricatus Reichb.
Stipa tortilis Desf.

FILICES.

Ophioglossum vulgatum L. var.

PLANTS OF RIYADH, SAUDI ARABIA.

(Collected in October 1938.)

Acacia sp. (probably A. Seyal Del).
Aerua javanica (Burm.) Lam.
Amaranthus Blitum L.
Anvillea Garcine (Burm.) DC.
Artemisia monosperma Del.
Blepharis edulis (Forsk.) Pers.
Capparis galeata Fres.
,, *spinosa* L.
Cassia obovata Coll.
Corchorus trilocularis L.
Daemia cordata R. Br.
Digera arvensis Forsk.
Haloxylon Schweinfurthii Asch.
Lycium Barbarum L.
Morcandia arvensis DC.
Oxalis corniculata L.
Peganum Harmala L.
Picridium tingitanum Desf. var. *subintegrum* Boiss.
Pulicaria crispa (Forsk) Benth. and Hook.
Punica Granatum L.
Rhazya stricta Dcne.
Solanum nigrum L.
Trisetum pumilum Kunth. (grown from seed collected in Dahana).
Zizyphus nummularia Walk et Arn.

SOME NOTES ON THE EDIBLE PLANTS OF KUWAIT AND THOSE USED MEDICINALLY.

Asphodelus tenuifolius Cav. 'Burwug'.

This plant is used by the Badawin of Kuwait in making ' 'Igt', which is a form of dried milk; it is made especially for use during the summer and is mixed with water and eaten with dates.

Citrullus Colocynthis (L.) Schrad.

This plant known to the Arabs as 'Esherri' is their main purgative. The seeds are collected when the fruit is ripe and seven seeds are taken at once as a strong purgative. Sheep sometimes eat the fruit when it is green.

Dipcadi erythraeum Webb et Benth. 'Busal Mow'.

The bulb of this plant is very juicy though rather tasteless; it is dug up and eaten by all Badawin children.

Heliotropium undulatum Vahl 'Rum-Rām'.

This plant is used by Badawin as a cure for snake bite. The plant is dried and pounded up, and made like tea with hot water. This is then strained, and the patient is given the liquid to drink, and the 'leaves' are bound on to the bite. Other methods, such as branding and keeping the patient awake are also used, as the 'Rum-Rām' will not effect a cure by itself. The Badawins tell you that the Monitor lizard ('Wurral') when bitten by a snake, has been seen to go to this plant and roll in it.

Lygia Passerina L. 'Kharāit'.

This is also used among the Badawin as a purgative, mainly in spring when it is picked and eaten green. It may be dried also and pounded up.

Malva parviflora L. 'Khubāiz'.

Among the Persian community in Kuwait this plant is eaten a great deal when it is young and green. It is cooked like spinach.

Neurada procumbens L. 'Sa'adān'.

Badawin children are very fond of the young circular seeds of this plant to eat.

Haplophyllum tuberculatum Juss. 'Al Masāicha'.

This plant is used among the Badawin of N.-E. Arabia as a cure for a scorpion sting. The plant is picked and quickly put into a pocket and then in a dark bag to dry. Some of the leaves are pounded up and mixed with a few drops of hot water and bound on to the place where the person was stung. It is said to be a quick cure and to relieve pain at once.

Rumex pictus Forsk. 'Hambusis' and *Rumex vesicarius* L. (Hamēth) are both eaten by townspeople and Badawin alike.

Emex spinosus Camped. 'Al Hambizān'.

The white root of this plant is eaten by Badawin children.

Scorzonera papposa DC. 'Rubāhla'.

The brown carrot-like root of this plant when peeled is eaten by Badawin and is very tasty.

Teucrium Polium L. 'Al Jādah'.

This plant is used as a cure for Basrah fever and is sold dried in the bazaars of Kuwait. The leaves are pounded up and brewed with boiling water into a kind of tea. Some of this is drunk and some of it poured over the person. Sheikh Mubarak of Kuwait always used this cure when he had fever. A specimen was sent by Dr. C. S. G. Mylrea of the American Mission Hospital in Kuwait to the School of Tropical Medicine, who sent it on to Messrs. Parke Davis & Co.

Following is a report from them by Mr. E. M. Holmes dated 30-11-20.

Report on a woolly leaved herb.

'The specimen received from Messrs. Parke Davis & Co. has been carefully examined by me, with the following result :—

"The minute flowers are evidently those of a Labiate plant possessing the character of the genus *Teucrium* of the species *Teucrium Polium*. The plant was formerly used as a herb in

Europe, and in Spain still retains the vernacular name of *Poleo montano*. The plant is supposed to be the Polion of the Greeks and is said by Arabian writers to be deobstruent, diuretic, and anthelmintic and tonic. It is mentioned by Dioscorides, 111, 115, Pliny, 21, 7, 120. In Bombay it is one of the drugs sold under the name of 'Jadah' and comes from Bandar Abbas. It is described by Dr. M. Dymock in *Mat. Med. West India*, 2nd ed. p. 616, and accords exactly with the specimen received".'

The United States Dispensatory further says:—

'Plant said to have been used advantageously in cholera in the Levant, a specimen of which was sent to Paris proved to be *Teucrium Polium*—which we have no doubt was identical with the drug you sent to us.'

Trigonella stellata Forsk. 'Nifl'.

The Badawin women of the great Shammar tribe of Northern Arabia use this plant when dried to put on their hair after it has been washed.

Arnebia decumbens Coss. et Kral. 'Chahil'.

The root of this plant, which is crimson, is used by some Badawin women and girls as a 'rouge'. The freshly pulled up root is rubbed lightly on the cheeks and it gives a perfect colour to them.

Atriplex sp. aff. *A. pariflora* Lowe. 'Hartabeel'.

This plant when young is eaten by the Persian population of Kuwait as a kind of spinach.

SOME TREES AND BUSHES OF KUWAIT AND THEIR USES.

Calotropis procera R. Br. 'Ashurr'.

This tree is used for making gunpowder. The bark is first made into charcoal, and then pounded up very fine and used with saltpetre. The tree has no doubt been brought up from Hassa where it is very common, and grows here only in one village (Fantas) some 20 miles south of Kuwait town.

Zizyphus Spina-Christi Willd. 'Sidr'.

The dried and pounded leaves of this tree are used by the town women of Kuwait as a hair wash. It is also used for washing the dead.

The Badawin makes his camel stick 'Misha'ab' from the branches of these trees which grow in great quantities in the Summan region of Saudi Arabia. The fruit is sold in the bazaars and is much liked by the town people and Badawin alike.

Haloxylon salicornicum Bge. 'Hamdh' or 'Rimdh'.

There are many bushes of the Chenopodiaceae which are classed under the Arabic names given above. These are all valuable as firewood in the desert and also for grazing for camels, owing to their salt properties.

A NOTE ON THE EMBRYOLOGY OF THE GROUND NUT (*ARACHIS HYPOGAEA* L.)

BY

I. BANERJI.

(*Department of Botany, Calcutta University*).

(*With two text-figures*).

Arachis hypogaea is a crop plant of great economic importance. In India, it is cultivated extensively in Bombay, Madras and the Central Provinces. In Bengal, Mysore and in other parts of India attempts are now being made to grow ground-nut on an extensive scale. The plant is grown as a *rabi* crop.

The literature on the embryology of Leguminosae is extensive. It has recently been reviewed by Schnarf (**9**), Roy (**6**) and others. Excepting a few cases which, however, require reinvestigation, the development of the female gametophyte in the family was found to be of the normal type. Guignard (**1**), Souèges (**11**), Samal (**8**) and others have studied the development of the embryo. Considerable variation has been noted in the development of the pro-embryo and the suspensor.

Reed (**4**) appears to be the only investigator who has worked on the embryology of *Arachis hypogaea*. He has only described the fully developed gametophyte and certain stages in the development of the embryo in connection with his studies on the anatomy, ecology and embryology of the plant.

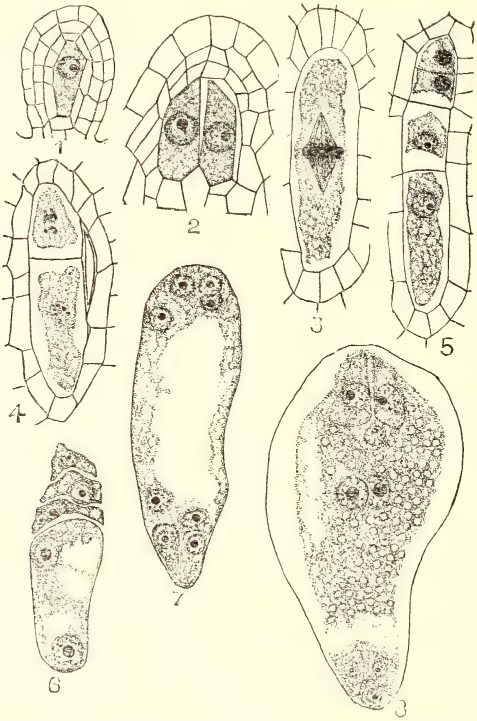
The material used in this investigation was obtained from plants grown in the University College experimental ground and was studied according to the customary methods.

As is characteristic of the family Leguminosae, the monocarpellary ovary bears the ovules on the ventral suture. Generally the ovules are two in number, but sometimes three or only one have been noted. The ovule initials are at first noted as small papillate processes on the placenta. Due to more active cell division on one side of the ovule they gradually curve and take up an anatropous position. At this time the outer wall of the ovule generally comes in contact with the wall of the ovary, but the curvature of the ovule does not appear to be due to the contact with the ovarian wall as has been suggested by Reeves (**5**) working on *Medicago*. Both the ovules curve in the same direction and the curvature is always towards the stylar end of the ovary. It is interesting to note in this connection that Reeves (**5**) working on *Alfalfa* found the curvature of the ovule towards the base of the ovary. In *Albizzia Lebbeck* and *Phaseolus vulgaris*, Maheshwari (**2**) and Weinstein (**12**) found the ovules curving towards the stylar end of the ovary.

The origin of the integuments becomes apparent along with the curvature of the ovule. Both the integuments arise from the outer layer of cells of the ovule and in the early stages of their development are composed of two layers of cells. The inner integument is first noted, but very soon the outer integument makes its appearance. At the time of differentiation of the integuments the megaspore mother cell is generally in the early stages of heterotypic prophase. The growth of the outer integument is more rapid than the inner and by the time the megaspore mother cell is in synopsis, the outer integument reaches the same level as the inner. From this stage onwards, the growth of the outer integument is more rapid on the side of the ovule opposite to that of the placenta, and as a result it very soon completely encases the ovule. Both the integuments take part in the formation of the micropyle, at which region they are comparatively thick.

A single archesporial cell usually differentiates in the third layer of the nucellus and directly functions as the megaspore mother cell. The origin of the archesporial cell or cells, in the third layer of the nucellus appears to be a common feature in the Papilionatæ and has been noted previously by

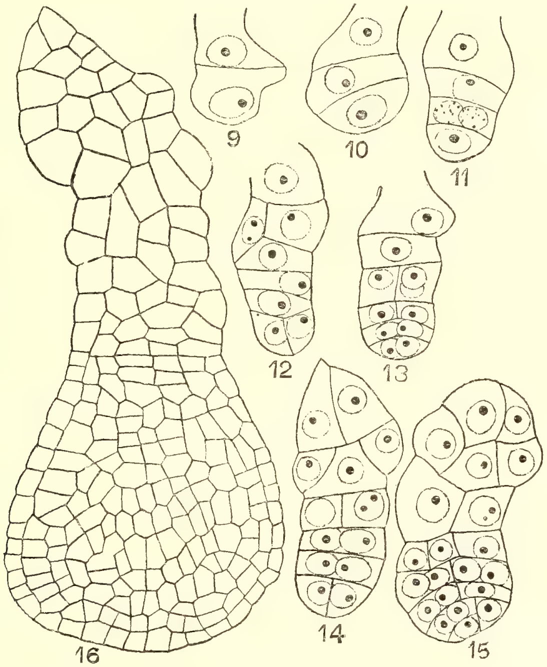
Roy (**6**), Paul (**3**) and others. Two megaspore mother cells lying side by side have been noted in some preparations (text-fig. 2). Reeves (**5**) records the occurrence of two or more sporogenous cells side by side in *Alfalfa*, Singh and Shivapuri (**10**) in *Neptunia oleacea* and Paul (**3**) in *Tamarindus indicus*. The cell covering the megaspore mother cell usually divides before the reduction division and as a result the megaspore mother cell is pushed inside the nucellus (text-fig. 1 and 2). The megaspore mother cell passes through the usual stages of meiosis. During the heterotypic metaphase a bipolar spindle is oriented (text-fig. 3) and the movement of the chromosomes is regular. There is a well defined interphase and the daughter nuclei become well organised and separated by a cell wall. During the homotypic division both the cells usually divide at about the same time (text-fig. 4). As previously noted by Maheshwari (**2**) and Roy (**6**) the lower cell of the dyad is comparatively longer than the upper. This inequality in the size of the dyads appears to be a characteristic feature of the Papilionatæ. As a result of the homotypic division four macrospores are produced which are arranged in a linear row and separated by cell walls (text-fig. 5). In no case was a *T*-shaped arrangement of tetrads observed. The lower or the chalazal macrospore alone functions while the rest degenerate. It appears from the results obtained by previous investigators that in most Papilionaceous plants the chalazal megaspore is functional. Saxton (**7**), however, found the third megaspore from the micropylar end to be functional in *Cassia tomentosa*.



Text-figures 1-8. *Arachis hypogaea* L. Fig. 1. Megaspore mother cell ×500. Fig. 2. Two megaspore mother cells lying side by side ×900. Fig. 3. Heterotypic metaphase ×900. Fig. 4. Homotypic division ×900. Fig. 5. Linear tetrad of megaspores ×900. Fig. 6. Binucleate stage of the embryo-sac; note that the upper three megaspores have not degenerated ×900. Fig. 7. Eight-nucleate embryo-sac ×900. Fig. 8. Mature female gametophyte; note presence of starch grains in the embryo-sac ×900.

The functioning megaspore is usually capped by dark staining masses—the remnants of the other degenerated macrospores. It is usually deeply embedded in the nucellus due to the repeated division of the cover cells. The nucleus of the functioning megaspore next divides and gives rise to the primary micropylar and primary chalazal nuclei. It is interesting to note that sometimes the binucleate stage is reached before the degeneration of the three upper megaspores. Text-fig. 6 illustrates such a condition. By two-nuclear divisions an eight-nucleate embryo-sac is produced and a big vacuole is noted in the centre of the sac. From the two-nucleate stage onwards the parietal cells surrounding the embryo-sac show signs of disintegration. At the eight-nucleate stage the embryo-sac increases considerably in size and the chalazal end becomes very narrow.

The mature embryo-sac is somewhat oval with the antipodal end tapering. The three antipodals become separated from the main body of the embryo-sac and appear to be surrounded by cytoplasmic membranes. They degenerate very soon, as appears to be common in the sub-family Papilionatæ. The synergids are pear-shaped in appearance with the nuclei disposed at the micropylar end and the vacuole below. No filiform apparatus could be detected. The egg cell is placed between the synergids and extends beyond them into the embryo-sac. There is a large vacuole at the apical region of the egg and the nucleus is placed in the denser cytoplasm at the base. The two polar nuclei lie close together, near the central region of the sac, they fuse later. The mature embryo-sac as previously noted by Reed (**4**), is full of starch grains (text-fig. 8). The occurrence of starch grains in the embryo-sac of higher plants seems to be of frequent occurrence.



Text-figures 9-16. *Arachis hypogaea* L. Stages in the development of the embryo. Figs. 9-15 ×400 : Fig. 16 ×180.

As stated previously, Reed (**4**) has only described the mature gametophyte of *Arachis hypogaea,* and has not worked out its development. His account of the female gametophyte agrees with our observation, but his figures illustrating the structure of the synergids, the egg and the polar fusion nucleus appear to give an entirely wrong impression of the organisation of the mature embryo-sac.

Fertilisation appears to be porogamous as remnants of pollen tubes were seen in the micropylar end of the embryo-sac in a number of cases. Before the first division of the endosperm nucleus the cells of the gynophore immediately surrounding the ovules divide rapidly; as a result each of the ovules appears to be encased by 4 to 6 layers of brick-shaped cells, one above the other in tiers, and without any intercellular space. These present a characteristic appearance. These cells, however, disappear during the later stages of the development of the fruit and are replaced by a few layers of ordinary parenchymatous cells beyond which are noted large cells with abundant starch grains.

The fertilised egg rests for some time before division. The first division is transverse resulting in an apical and a basal cell (text-fig. 9). The apical cell divides again by a transverse wall and a three-celled proembryo is produced (text-fig. 10). Mostly, however, due to the division of the basal cell a 4-celled proembryo is produced (text-fig. 11). This is followed by vertical division in the terminal cell (text-fig. 12). The nature of the succeeding divisions could not be determined. At an early stage the embryo-forming region is clearly distinguished from the suspensor region by its smaller cells and denser cytoplasm (text-figs. 13, 14 and 15). It is interesting to note that similar differentiation of the embryo-forming region has been noted by Samal (**8**) working on *Crotalaria juncea*. The cells of the embryo-forming region divide mostly by anticlinal and periclinal walls, whereas the cells above divide mostly by oblique walls and give rise to the massive suspensor which functions as a haustorium (text-fig. 16). The dermatogen is differentiated in the embryo comparatively late. At this time the suspensor enlarges, its end becomes sagittate and is pushed inside the groove of the micropyle. After the differentiation of the dermatogen, cell division in the embryo-forming region continues and a pear-shaped embryo is formed where tissue differentiation appears to be complete (text-fig. 16). The cotyledonary primordia appear as two swellings on opposite sides of the pear-shaped embryo and soon develop into diverging projections, between which the plumule is located. The suspensor is massive, but comaratively short, its cells as observed by Reed (**4**) are large and haustorial in nature. The embryo is straight and the plumule consists of a terminal and two lateral buds developed in the axils of the cotyledons.

Reed (**4**) has described certain stages in the development of the embryo. He states that after the first division of the egg, the further divisions are in three planes. Our investigation shows that division in three planes only results after the proembryo consisting of four cells has been formed, and it appears that the last two cells of the proembryo give rise to the embryo-forming region while the cell above takes part in the development of the suspensor.

SUMMARY.

The development of the female gametophyte in *Arachis hypogaea* was found to be of the normal type. The chalazal megaspore always functioning. The mature gametophyte is 8-nucleate and is filled up with starch grains. Fertilisation is porogamous. A proembryo of four cells is formed. The last two cells of the proembryo appear to give rise to the embryo. The upper cells of the proembryo form the suspensor which is composed of comparatively bigger cells and functions as an haustorium.

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EARTH-EATING AND SALT-LICKING IN INDIA

BY

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Analyses XL—XLVII

XL. *Soil from Salt Lick*

Serial No. 25.

Locality—Madanpur Beat, Marora Range, Jhansi Forest Division.

Collected and sent by—The Divisional Forest Officer, Jhansi.

Buff coloured clayey lumps crumbling fairly easily to powder. Powder soft.

Minerals	4·25	per cent
Clay	17·33	,,
Sand	61·19	,,
Organic debris	1·52	,,
Moisture	3·40	,,

Fine Earth (20 mesh sieve)	91·773	per cent.
Insoluble in nitric acid	45·619	,,
Soda (Na_2O)	2·127	,,
Potash (K_2O)	1·457	,,
Magnesia (MgO)	2·048	,,
Lime (CaO)	4·650	,,
Alumina (Al_2O_3)	3·411	,,
Silica (SiO_2) soluble	16·987	,,
Carbon dioxide (CO_2)	3·388	,,
Phosphorus (P_2O_5)	0·178	,,
Manganese (Mn)	0·064	,,
Ferric oxide (Fe_2O_3)	6·839	,,
Moisture and organic matter	4·952	,,

Remarks : 1. The soil contains traces of chlorine, 0·046 per cent. water-soluble organic matter, and 0·043 per cent. water-soluble inorganic matter.

2. The soil disintegrates when acted upon by nitric acid (sp. gr. 1·42) in the proportion of 1 part of acid to 15 parts of water.

3. Analysed by S. K. Chhapgar, b.sc.

XLI. *Common Earth*

Serial No. 26.

Locality—Madanpur Beat, Marora Range, Jhansi Forest Division.

Collected and sent by—The Divisional Forest Officer, Jhansi.

Fine dark-fawn powder with grit, and debris—straw, twigs, rootlets, dead leaves, etc.

Minerals	19·94	per cent.
Clay	4·32	,,
Sand	68·47	,,
Organic debris	3·52	,,
Humus	0·32	,,
Moisture	1·71	,,

Fine Earth (20 mesh sieve)	77·772	per cent
Insoluble in nitric acid	59·084	,,
Soda (Na_2O)	0·853	,,
Potash (K_2O)	0·419	,,
Magnesia (MgO)	0·211	,,
Lime (CaO)	0·274	,,
Alumina (Al_2O_3)	1·190	,,
Silica (SiO_2) soluble	7·219	,,
Phosphorus (P_2O_5)	0·058	,,
Ferric oxide (Fe_2O_3)	3·161	,,
Moisture and organic matter	5·494	,,

Remarks: 1. The earth contains traces of manganese, 0·078 per cent. of water-soluble inorganic matter and 0·132 per cent. of water-soluble organic matter.

2. The soil was collected in an area adjoining Salt-Lick No. 25.

3. Analysed by S. K. Chhapgar, B.SC.

XLII. *Common Earth*

Serial No. 40.

Locality—Dudhai Zamindari Forest, Lalitpore Range, Jhansi Division.

Collected and sent by—The Forest Ranger, Lalitpore Range, Jhansi.

Friable cement-grey lumps with a few rootlets and other organic detritus. Powder soft.

Minerals	3·01	per cent.
Clay	26·97	,,
Sand	64·86	,,
Organic debris	1·00	,,
Humus	0·34	,,
Moisture	3·74	,,

Fine Earth (20 mesh sieve)	94·040	per cent
Insoluble in nitric acid	64·977	,,
Soda (Na_2O)	2·980	,,
Potash (K_2O)	1·283	,,
Magnesia (MgO)	0·444	,,
Lime (CaO)	0·987	,,
Alumina (Al_2O_3)	3·040	,,
Silica (SiO_2) soluble	10·930	,,
Phosphorus (P_2O_5)	1·758	,,
Manganese (Mn)	0·030	,,
Ferric oxide (Fe_2O_3)	2·250	,,
Moisture and organic matter	4·343	,,

Remarks: 1. The soil contains traces of carbon dioxide and chlorine, 0·115 per cent. of colloidal silica and other inorganic matter, and 0·118 per cent. of water-soluble organic and inorganic matter.

2. The earth was collected from the neighbourhood of Salt-Lick No. 41.

XLIII. *Soil from Salt-Lick*

Serial No. 41.

Locality—Dudhai Zamindari Forest, Lalitpore Range, Jhansi Division.

Collected and sent by—The Forest Ranger, Lalitpore Range, Jhansi.

Hard greyish and yellowish lumps. Powder soft.

Minerals	6·94	per cent.
Clay	34·70	,,
Sand	66·43	,,
Organic debris	2·58	,,
Humus	0·02	,,
Moisture	3·74	,,

Fine Earth (20 mesh sieve)	90·820	per cent.
Insoluble in nitric acid	57·433	,,
Soda (Na_2O)	4·804	,,
Potash (K_2O)	1·263	,,
Magnesia (MgO)	0·183	,,
Lime (CaO)	1·363	,,
Alumina (Al_2O_3)	0·272	,,
Silica (SiO_2) soluble	13·410	,,
Phosphorus (P_2O_5)	1·022	,,
Manganese (Mn)	0·128	,,
Ferric oxide (Fe_2O_3)	0·617	,,
Moisture and organic matter	9·356	,,

Remarks: 1. The soil contains traces of chlorine and carbon dioxide 0·016 per cent. colloidal silica, 0·587 per cent. water-soluble inorganic matter and 0·102 per cent. water-soluble organic matter.

2. 'The licks are visited by all animals alike, there is no distinction in species. Only timings of visits differ. The pigs and blue bulls go early after sunset to eight in the night, but sambhars are always late frequenters. It is used after meals as well as before meals. There is restriction as regards season, they begin licking from October and after, till March. They use it mostly during the winter, especially after a spell of winter rain, when the ground is wet.' (M. A. Gani, Forest Ranger; 10–2–1929.)

XLIV. *Common Earth*

Serial No. 42.

Locality—Richa Mahoti Zemindari Forest, Lalitpore Range, Jhansi Division.

Collected and sent by—The Forest Ranger, Lalitpore Range, Jhansi.

Buffy friable lumps with rootlets. Powder soft.

Minerals	3·26	per cent.
Clay	14·43	,,
Sand	83·48	,,
Organic debris	0·28	,,
Humus	1·06	,,
Moisture	1·30	,,
Fine Earth (20 mesh sieve)	96·230	per cent.
Insoluble in nitric acid	78·539	,,
Soda (N_2O)	1·699	,,
Potash (K_2O)	0·766	,,
Magnesia (MgO)	0·198	,,
Lime (CaO)	0·272	,,
Alumina (Al_2O_3)	0·171	,,
Silica (SiO_2) soluble	8·966	,,
Phosphorus (P_2O_5)	0·116	,,
Manganese (Mn)	0·118	,,
Ferric oxide (Fe_2O_3)	1·798	,,
Moisture and organic matter	7·889	,,

Remarks: 1. The soil contains traces of sulphur, chlorine and carbon dioxide, 0·030 per cent. water-soluble inorganic matter, and 0·033 per cent. water-soluble organic matter.

2. The sample was collected in the neighbourhood of Salt-lick No. **43.**

XLV. *Soil from Salt-Lick*

Serial No. 43.

Locality—Richa Mahoti Zemindari Forest, Lalitpore Range, Jhansi Division.

Collected and sent by—The Forest Ranger, Lalitpore Range, Jhansi.

Buffy friable lumps. Powder soft.

Minerals	4·41	per cent.
Clay	23·53	,,
Sand	69·61	,,
Organic debris	2·63	,,
Humus	0·05	,,
Moisture	2·93	,,

Fine Earth (20 mesh sieve)	92·210	per cent.
Insoluble in nitric acid	65·217	,,
Soda (Na_2O)	3·635	,,
Potash (K_2O)	0·888	,,
Alumina (Al_2O_3)	0·348	,,
Magnesia (MgO)	0·288	,,
Lime (CaO)	0·091	,,
Silica (SiO_2) soluble	13·330	,,
Phosphorus (P_2O_5)	0·077	,,
Manganese (Mn)	0·021	,,
Ferric oxide (Fe_2O_3)	0·402	,,
Moisture and organic matter	3·211	,,

Remarks : 1. The soil contains traces of chlorine, sulphur and carbon dioxide, 0·071 per cent. colloidal silica, 0·173 per cent. water-soluble inorganic matter, and 0·067 per cent. water-soluble organic matter.

2. Same as for salt-lick No. 41.

3. When sending samples of salt-licks the Range Officer of the Lalitpore Range (M. A. Gani) wrote to say that the droppings of animals which have eaten the earth of the licks can be easily recognized : they are dusky earth-coloured and heavier than ordinary droppings. He also said that the soil seems to be excreted separately, and further added that he had examined different droppings and found that they carried very little vegetable matter and appeared to be made almost wholly of the soil in colour and composition.

At our request we were supplied with samples of nilgai dung taken from Richa Mahoti No. 42 Forests.

The ordinary dung (*B*) of animals that had not yet visited the lick consisted of light dark chocolate-brown balls or lumps. They contained 8·109 per cent. moisture, and left on calcination 13·607 per cent. of a greyish white ash of specific gravity 2·313 at 30°C.

The dung (*A*) of animals that had visited the licks consisted of dull grey balls or lumps. They contained 3·058 per cent. moisture, and left on calcination 76·039 per cent. of a rusty brown ash of specific gravity 2·545 at 30°C.

On analysis (S. K. Chhapgar) the dungs were found to have the following centesimal composition :

	B	*A*
Moisture	1·491	0·612
Insoluble in nitric acid	11·964	74·593
Sodium (Na_2O)	1·973	1·457
Potassium (K_2O)	3·023	1·394
Magnesium (MgO)	4·900	1·181
Calcium (CaO)	31·466	1·955
Aluminium (Al_2O_3)	2·371	7·555
Iron (Fe_2O_3)	11·464	4·206
Silica (SiO_2) soluble	13·456	6·046
Carbon dioxide (CO_2)	13·339	traces
Sulphur (SO_3)	0·090	...
Phosphorus (P_2O_5)	3·986	0·451
Chlorine (Cl)	0·277	0·250
Manganese (Mn)	...	traces

XLVI. *Soil from Salt-Lick*

Serial No. 44.

Locality—Danwar Reserve Forest, Lalitpore Range, Jhansi Division.

Collected and sent by—The Forest Ranger, Lalitpore Range, Jhansi.

Yellowish-brown earth with clayish lumps either yellowish-brown or cement-grey. Powder soft.

Minerals	4·10	per cent.
Clay	23·29	,,
Sand	65·42	,,
Organic debris	0·70	,,
Humus	0·53	,,
Moisture	2·03	,,

Fine Earth (20 mesh sieve)	93·530	per cent.
Insoluble in nitric acid	76·367	,,
Soda (Na_2O)	2·476	,,
Potash (K_2O)	0·387	,,
Magnesia (MgO)	0·138	,,
Lime (CaO)	0·336	,,
Alumina (Al_2O_3)	0·349	,,
Silica (SiO_2) soluble	13·000	,,
Phosphorus (P_2O_5)	0·019	,,
Ferric oxide (Fe_2O_3)	2·375	,,
Moisture and organic matter	4·390	,,

Remarks : 1. The soil contains traces of carbon dioxide, sulphur, chlorine, and manganese, 0·013 per cent. water-soluble inorganic matter, and 0·006 per cent. water-soluble organic matter.

2. Same as for salt-lick No. 41.

XLVII. *Common Earth*

Serial No. 45.

Locality—Danwar Reserve Forest, Lalitpore Range, Jhansi Division.

Collected and sent by—The Forest Ranger, Lalitpore Range, Jhansi.

Buffy earth and friable lumps. Powder soft.

Minerals	4·77	per cent.
Clay	23·74	,,
Sand	72·52	,,
Organic debris	0·43	,,
Humus	2·81	,,
Moisture	1·93	,,

Fine Earth (20 mesh sieve)	93·930	per cent.
Insoluble in nitric acid	76·730	,,
Magnesia (MgO)	0·239	,,
Lime (CaO)	0·279	,,
Alumina (Al_2O_3)	4·108	,,
Silica (SiO_2) soluble	10·470	,,
Manganese (Mn)	0·022	,,
Ferric oxide (FeO_3)	2·231	,,
Moisture and organic matters	3·322	,,

Remarks : 1. The soil contains traces of chlorine and carbon dioxide.

2. The sample was collected in the neighbourhood of salt-lick No. 44.

REVIEWS.

I.—THE FIGHT TO LIVE, by Raymond L. Ditmars. Lovat Dickson Ltd., 8/6 net.

Raymond Ditmars is the Curator of Mammals and Reptiles in New York Zoological Park and has to his account several readable books on Natural History. His present theme is an attempt to sketch in broad outline the struggle to which all living creatures are condemned if they are to survive and have their being. The right to live implies a fight to live. To each creature Nature has given the implements whereby it might earn its livelihood. To the predator the weapons of attack, to the prey the means of defence. Mr. Ditmars takes stock of this armoury; commencing with the teeth, claws, horns and weapons of offence of the higher animals, he goes down the scale to snakes with their deadly fangs and to lower creatures which slay with their stings. More ingenious than these outright weapons of attack are the methods of defence employed by the victims. A body covered with bristling spines is one notable way to avoid being eaten. The device has been adopted by a host of unrelated creatures from the bristling porcupine to spiny fishes, crustaceans and hairy caterpillars. The author describes the porcupine as defending himself with vigorous jerks of his bristling tail. This is certainly not true of the Indian Porcupine whose way is to rush backwards at the attacker and so to impale him with his battery of sharp pointed quills. Armour plating has gone out of fashion with animals, at present the Armadillos and Scaly Ant-eaters are the only large animals which adopt this defence. From actual body armour we come to yet more subtle means of defence—mimicry, camouflage, smoke screens and poison gas. Mr. Ditmars writes interestingly about these various devices and of the creatures which employ them. Man has copied and vastly improved on the means of defence and attack employed by animals and uses them now largely for the more rapid and wholesale destruction of his fellow men. He is intelligent. Man, Nature's insurgent son, defies her laws. His intelligence enables him to prolong life, to sustain and multiply his unfit, to adapt himself to any environment. A victor over Nature he becomes a victim to his own ingenuity.

II.—THE VALLEY OF FLOWERS, by Frank S. Smythe. Hodder and Stoughton. 18 sh. net.

All Mr. Smythe's books on mountaineering are good to read. This book is the story of a Himalayan holiday; a rest after four strenuous expeditions. It tells of four happy months of wandering in the Central Himalayas and nowhere in their vast range are the Himalayas more impelling in grandeur. From east to west the towering peaks fill the northern sky. Within that grand panorama rise Nanda Kot and Nanda Devi, goddess of the Himalayas, the great massif of Hathi Parbat, Kamet climbed by the author in 1931, the snows of sacred Badrinath and Nilkanta, which in its isolated splendour is perhaps the most beautiful mountain in all the Himalayas. Mr. Smythe writes as a mountaineer freed from the thraldom of cities and happy in his mountains. He has read and now interprets the message of flower decked valleys and steep gorges, of serene vistas of alp, forest, snow field and glacier hung peaks, swept with tempest and rain, veiled in white mists, or gladdened with bursts of sunshine. This is the essence of his book. His valley of flowers is the Bhyundar Valley, where grow primulas so blue that they seem to light the hill sides. Here are asters and gentians and lush meadows carpeted with snow white drifts of anemones, golden lily-like *Nomocharis,* marigolds, delphiniums, violets and blue *Corydalis,* wild roses, flowering shrubs and rhododendrons—flower filled pastures set against a frieze of silver birches and shining snow peaks. Earth has fewer fairer vistas to offer. Mr. Smythe writes in his book of the *Abominable Snowmen* whose mysterious tracks he saw on the snows of Nilgiri Parbat. The mysterious foot prints on the snows of the higher Himalayas, seen by the author and other explorers, have drawn various conjectures as to the identity of the owners. Most appealing to the popular imagination is the theory that the foot prints were made by a mysterious race of mountain men to whom local legend ascribes the name 'Abominable Snow Men'. This legend probably has its origin in Hindu Mythology. Hindu Epic Literature abounds in stories of warriors and sages who, relinquishing the world and its vanities, retired to the Himalayan fastnesses, where by fasting and meditation they overcame the forces of evil and acquired such spiritual power as made gods and men tremble. It is a pity to strip the meat of romance from the dry bones of fact. The most likely explanation is that the foot prints are those of bears—either the Kashmir Brown Bear which inhabits the Western Himalayas or the Tibetan Blue Bear which occurs in the eastern portion of the range. These bears keep to the high levels in summer, living on the grassy slopes above the tree line. The human-like impress of their broad feet in the snow might easily be taken for giant human tracks. Mr. Smythe's book is illustrated with many colour photos of Himalayan scenery and contains appendices of the flowering plants collected by him in the region, which botanists and horticulturists will find useful.

III.—LAC CULTIVATION IN INDIA, by P. M. Glover. Pp. 147; 9 text-figures, 2 coloured plates, 14 black-and-white plates. Indian Lac Research Institute, Namkum, Ranchi, Bihar; 1937. Price Rs. 2.

This is a second and revised edition of *A Practical Manual of Lac Cultivation,* published by the author in June 1931. 'During the past six years a great deal of work has been done at the Indian Lac Research Institute, and as a result much information of practical value to the cultivator has been obtained, and is incorporated in this book, the scope of which has been widened to include matter likely to be of interest to the educated cultivator. The illustrations with a few exceptions are entirely new.'

The value of this volume cannot be overstated. It will prove an aid in the hands of every person interested in lac cultivation.

J. F. C.

IV.—SUPPLEMENT TO THE FLOWERING PLANTS OF MADRAS CITY AND ITS IMMEDIATE NEIGHBOURHOOD, by E. Barnes. Pp. 46; 4 plates. *Bulletin of the Madras Government Museum*; 1938. Price Re. 1-10-0.

This brochure is a welcome addition to the *Flora of Madras City*, published in 1929. It contains a description of 50 species and several varieties not included in the previous publication. The author first gives notes for distinguishing the plants described in this supplement from those included in the main volume of the *Flora of Madras City*, and then passes to the detailed descriptions of families, genera and species. An excellent production.

J. F. C.

V.—HINTS ON MUSEUM EDUCATION, by J. C. Basak. Pp. 1-282 (1938).

It is very difficult to review a work which deals with subjects quite alien to what one would expect from its title; such unfortunately is the case with the work under review. From the title 'Hints on Museum Education' one would expect a guide for museum authorities, such as museum curators and others responsible for the management of museums, regarding the methods to be adopted for making museums serve for the advancement of knowledge, but this is exactly what is wanting. In an introductory chapter the author deals with the importance of educational museums, but his method of treatment is very subjective, and so many subjects are mixed up in the short compass of 14 pages that the main issue becomes almost shrouded in details that have little to do with museum education. In a second chapter under the heading

'Preliminary Remarks' are discussed such diverse subjects as the Spread of Museum Knowledge, Useful *versus* Ornamental Knowledge, Well-directed Education, Memory not to be Taxed Improperly, Instances of Useful Knowledge, Study of Arts and Sciences and Exhibits of the Three Kingdoms, General Knowledge of Technical Subjects with sub-headings 'Botany' and 'Zoology', Mental Hygiene and Child Psychology, Curious or Wrong Notions about Educational Museums, Mass Education in the Indian States, Children's Museums, and Properties of Objects as Perceived by the Five Sense Organs. The variety of subjects treated in this chapter makes one wonder what the author's conception of the functions of a museum is. No one denies the great service rendered to education by educational museums and exhibitions of industrial objects in science museums, but the author devotes a page or so to museum work and several pages to defective curricula of educational institutions, instances of useful *versus* useless knowledge, the importance of the study of arts and sciences, etc. In fact the work appears to be based on such an imperfect acquaintance with the work of museums either in Europe and America or even in India that it is very doubtful whether his analysis would serve any useful purpose. The major part of the book (pp. 57-270) is devoted to classification of exhibits under headings like Foods, Ordinary Drugs, Medical Appliances, Houses and Architecture, Stamps and Coins, Mechanics and Machines, Arts and Manufactures, Physics, Electricity, Some Mysterious Sciences, School Exhibits, Pictures, Nativities, Horoscopes, Useful and Interesting Information, Museum Library, Children's Museums, etc., arranged in 34 chapters. These accounts are useful compendia of a heterogeneous mass of information on very varied subjects, but their utility for museum education is very doubtful. As an instance may be noted the fact that whereas some 98 pages are devoted to a description of the properties of ordinary foods and drugs, less than half a page deals with objects that should be exhibited in the Food section, and not a word about Drug exhibits. In a final chapter under the heading 'Suggestions for Reformation' the author discusses certain recommendations of the representatives of the Museums Association as laid down in their report on the 'Museums of India' and offers suggestions for the improvement of the Indian museums. One of these is to transform the National museum of India, the Indian Museum, Calcutta, into what he considers to be an urgent need of the country, *viz.*, a science museum, a technical museum, a public health museum, a children's museum and everything else in museum line all combined into one; such an octopus, the exact functions of which the author has not set forth, has not been possible either in Europe or America, and one cannot understand how such an institution could ever be established in India with the very meagre funds that are available for museums in this country. Even if established, the incubus of such a gigantic institution is sure to stultify the main purposes which it is expected to serve.

B. P.

VI.—MORE DIFFICULTIES OF THE EVOLUTION THEORY, by Douglas Dewar. Pp. 206. London: Thynne & Co.; 1938. Price 8*s*. 6*d*. net.

This volume is a sequel to the author's *Difficulties of the Evolution Theory*, and a reply to Dr. Morley Davies' *Evolution and its Modern Critics*. Its aim is to question the validity of the theory of organic evolution and to set forth a number of objections to the theory, so coupled with the arguments of its supporters as to afford the student and the layman some sort of a basis on which to found judgment as to the soundness or otherwise of the theory. The objections are based solely on scientific ground, biological and palaeontological.

The book is well written and closely packed with information, excellent for reference.

J. F. C.

AN ASSURANCE.

I very much regret if my criticism of Major Handley's book *Hunter's Moon* in the *Journal* of the Bombay Natural History Society, dated 15th December 1934, caused him worry and pain, and I wish to make it clear that my criticism was not intended as a personal attack on Major Handley.

R. C. MORRIS.

[The criticism of *Hunter's Moon* which appeared in No. 3, Vol. xxxvii of the Society's *Journal* was an unsolicited contribution from Mr. R. C. Morris.—EDS.]

MISCELLANEOUS NOTES.

I.—OCCURRENCE OF TIGER IN NORTHERN SIKKIM AT 8,800 FT.

I am told you would be interested to hear of a tiger being killed in the extreme north of Sikkim.

At Lachung (8,800 ft.) in the valley of that name (the eastern confluent of the Tista R.), the Pipun (headman) showed me early this month the skin of a large tiger drying on a wall which he had just shot a little above the village after it had killed 6 ponies. None had ever been heard of in that region before by natives.

HANFORD HOUSE,
BLANFORD, DORSET,
ENGLAND.
April 19, 1938.

F. H. LISTER,
Lt. Colonel.

II.—MEASUREMENTS OF TIGERS SHOT IN THE NILGIRIS—1925-37.

Sex	Place	Body	Tail	Total length	Height at shoulder	Girth of Body	Girth of Neck	Remarks
Female	Mudumalai	...	...	8′4″	...	...	...	
Male	Plateau	...	...	9′4″	...	...	...	
Male	Plateau	...	...	8′1″	...	...	...	A young male.
Male	Plateau	6′0″	3′5″	9′5″	...	...	...	
Female	Plateau	...	...	8′8″	...	...	...	Recovered stiff.
Male	Plateau	6′3″	3′5″	9′8″	38″	51″	27″	Forearm 18″, a very heavy tiger.
Male	Plateau	...	...	8′11″	...	...	...	
Female	Mudumalai	5′5″	3′2″	8′7″	...	...	24″	
Female	Plateau	5′7″	3′1″	8′8″	34″	41″	27″	
Female	Plateau	5′10″	3′4″	9′2″	...	...	...	Measured round curves, as recovered stiff and tucked up—pegs not less than 8′9″.
Male	Mudumalai	6′3½″	2′11½″	9′3″	...	...	...	Curves 9′8″.
Male	Anaikatti	5′10″	2′10″	8′6″	38″	47″	31″	Forearm 20″.

Note.—All measurements taken between pegs except where otherwise stated.

WINCHCOMBE,
KALHATTI P.O.,
NILGIRIS, S. INDIA.
August 24, 1938.

E. G. PHYTHIAN-ADAMS,
Major.

III.—MEASUREMENTS OF PANTHERS.

Sex	Place	Body	Tail	Total length	Height at shoulder	Girth of Body	Girth of Neck	Remarks
Female	Poona ...	...	...	6′2½″	...	...	...	
Male	Raipur ...	54″	31″	7′1″	28″	29″	...	Forearm 11″.
Female	Poona ...	...	...	6′7″	...	...	...	Very long tail.
Male	Chittoor ...	...	...	7′2½″	...	...	...	
Male	Chittoor ...	...	...	7′4½″	...	...	...	
Male	Secunderabad	...	...	6′7″	...	...	...	
Male	Secunderabad	...	...	7′2″	...	...	...	
Female	Mysore ...	...	...	6′10″	...	...	...	
Male	Mysore ...	...	...	7′1″	...	...	20″	Very old male with short tail.
Female	Mysore ...	...	...	6′5″	22″	...	18″	Old female.
Male	Mysore ...	43″	29″	6′0″	...	...	16″	
Female	Bangalore	41″	30″	5′11″	24″	...	13″	
Female	Mysore ...	44″	26″	5′10″	...	...	...	
Female	Mysore ...	46″	31″	6′5″	23″	26″	16″	
Female	Mysore ...	47″	30″	6′5″	24″	27″	16″	
Male	Mysore ...	56″	32″	7′4″	29″	33½″	20½″	Very old male with two old wounds.
Male	Mysore ...	57″	33″	7′6″	29″	32″	21″	
Male	Mysore ...	55″	32″	7′5″	24″	31″	19½″	
Female	Mysore ...	48″	30″	6′6″	22″	26″	17″	
——	Mysore ...	45″	31″	6′4″	22½″	24″	15″	Sex omitted in register but presumably a young male.
Female	Mysore ...	51″	31½″	6′10½″	23″	28″	18½″	
Male	Mysore ...	46″	29″	6′3″	23″	24″	15″	} Two young males shot R and L.
Male	Mysore ...	45″	26″	5′11″	21″	22″	14″	
Male	Mysore ...	54″	34″	7′4″	26½″	33″	21″	
Male	Nilgiris ...	46″	28″	6′2″	20″	25″	16″	
Female	Nilgiris ...	47″	31″	6′6″	23″	25″	16″	
Male	Nilgiris ...	48″	34″	6′10″	23½″	26″	16¼″	
Female	Mysore ...	45″	28″	6′1″	23″	27″	16″	
Male	Mysore ...	55″	33½″	7′4½″	26½″	33½″	22½″	
Female	Nilgiris ...	44″	29″	6′1″	23″	25″	14″	
Female	Mysore ...	43″	29″	6′0″	24″	26½″	16″	
Female	Nilgiris ...	45″	30″	6′3″	23″	28″	16″	
Male	Mysore ...	44″	30″	6′2″	21″	25½″	17″	Recovered stiff.
Male	Nilgiris ...	49½″	32″	6′9½″	27″	31″	20½″	Recovered stiff—curves 7′3″.
Female	Nilgiris ...	46″	31″	6′5″	20″	...	16″	
Female	Mysore	44″	28″	6′	20½″	33″	16″	
Male	Nilgiris	54½″	33″	7′3½″	28″	32½″	20½″	Forearm 12″.
Female	Nilgiris	45½″	30½″	6′4″	22½″	25″	15″	Weight 78 lbs.

Note.—All measurements taken between pegs. Except the first seven on the list all the above were shot between 1926 and 1937.

WINCHCOMBE,
KALHATTI P.O.,
NILGIRIS, S. INDIA.
August 24, 1938.

E. G. PHYTHIAN-ADAMS,
Major.

IV.—MEASUREMENTS OF TIGER, PANTHER, BISON AND SAMBHUR.

I give below further measurements and weights:—

Tiger—

Female — 8′ (Mysore)
Male — 9′ 1″ (do.)
Female — 8′ 3″ (North Coimbatore)
Male — 9′ (South Coimbatore) – – weight = 421 lbs.
Do. — 8′ 8″ (North Coimbatore) – – 9′ 1″ over curves – skull = 13″ × 9″.
Do. — 9′ 5″ (North Coimbatore) do do. – skull = 14″ × 9½″.
Do. — 9′ 3″ (Nilgiris) – 9′ 8″ over curves—skull = 14¼″ × 9½″ – Circumference of head = 34″.
Do. — 8′ 8″ (Nilgiris) – Body = 70″ ; Tail = 34″ ; Height = 38″ : Circumference of head = 34″ ; Circumference of neck = 31″; Circumference of body 57″ ; Circumference of forearm = 20″.

Panther—

Male — 7′ ¼″
Do. — 6′ 5½″
Do. — 6′ ¾″
Do. — 6′ 10″ – – Weight = 118 lbs.
Do. — 7′ 1″ North Coimbatore.
Female — 6′ 2″
Do. — 6′ 2″
Male — 7′ 2½″
Do. — 7′ – – Skull = 9″ × 6″

Bison—

Bull—Horn spread = 36″ – weight = 2438 lbs.* North Coimbatore.
Bull— ,, = 34″ – weight = 1966 lbs.

Sambhur—

Stag—Horn length = 38½″; weight = 776 lbs.* ; Height = 60″ ; Length = 7′ 4″. (North Coimbatore).

HONNAMETTI ESTATE,
ATTIKAN—MYSORE P.O.,
S. INDIA.
July 23, 1938.

R. C. MORRIS.

V.—METHOD ADOPTED BY LEOPARDS IN HUNTING MONKEYS.

About 3 months ago, during the month of May 1938, I had the Ranipur block in the Banda Forest division of the United Provinces reserved for tiger shooting. Besides securing a magnificent tiger,

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* These bison and sambhur, were quite the most colossal specimens of their species I have ever seen : especially the bull, which weighed no less than 472 lbs. more than the next largest weight I have recorded to date, nearly 200 lbs. over a ton.

I again had the good fortune of witnessing a very interesting incident, which does not often fall to the lot of a shikari.

I actually saw a couple of leopards hunting and killing a langoor, the common black-faced monkey of our jungles. I suppose many sportsmen before this have observed leopards killing langoors, but as I have not seen this method described, I thought it would be rather interesting to send in my observations to the *Journal*. The incident took place as follows:—

The tiger mentioned above had killed the previous night at a place called Bhainsdara, in my block, and a beat had been arranged. The beaters had been sent about a mile away from my machan, from whence they proposed beating up the tiger. Stops had been duly placed and the utmost silence prevailed. Suddenly, langoors began swearing some distance away. My machan, which was on the top of a tree leafless at this time of the year, commanded a wonderful view of the surrounding jungle. Suddenly, through the clump of bamboos I saw a large leopard appear. The langoors leapt from tree to tree, in awful panic. The next instant I caught glimpse of another leopard bounding along below these trees.

In pursuit the leopards showed neither stealth nor discretion, theirs was the bold open plan of attack. One of them now jumped on to an isolated tree and began climbing it with great agility. One of the langoors observing this, instead of leaping to safety, jumped down to the earth, and was instantly caught and killed by the second leopard waiting below. Its death-cries were terrible and very piteous indeed.

I refrained from shooting as I thought that this incident would be unique of its kind, showing the tactics employed by leopards when hunting monkeys. The langoor was dragged into the thick bamboos and there much snarling and growling took place.

The hunt had ended and just as I began to make rough notes in my pocket-book, the sound of the beat became audible, and my attention was drawn to the business in hand. I heard a stop cough and then the rattle of stones, and then before me there stood the jungle king in all his magnificence, but panting from the terrible heat. A shot from my rifle laid him low. A lovely tiger measuring 9 ft. 8½ in. between pegs. The leopards momentarily came into view but disappeared in a nullah.

After the beat was over we examined the remains of the langoor, which had not been greatly eaten, owing to the approach of the beat. It is very extraordinary that during the terrible heat of a May day, leopards should be out hunting. I suppose they were driven to this extreme by the pangs of hunger.

I would be very grateful if other sportsmen would send in their observations of similar occurrences.

It would be very interesting to know as to whether this is the normal method adopted by leopards in hunting monkeys. It is a well-known fact that monkeys in forests live generally in company with deer such as *Chital*, and on the slightest suspicion of danger, specially at the approach of their deadly foe, the leopard, the *chital* give the warning cry and the monkeys in their turn take up the alarm and jump away from tree to tree to safer quarters.

MALERKOTLA STATE, IFTIKHAR ALIKHAN,
PUNJAB. *Heir Apparent.*
August 24, 1938.

[Deer frequently associate with monkeys. The explanation is the advantage they derive from being able to eat the fallen fruit and leaves which the monkeys drop in their careless and destructive feeding. Incidentally it is possible that the association is mutually beneficial, the persistent watchfulness of either being a safeguard against attack. Blanford speaks of langoors giving out their characteristic alarm call at the sight of bolting deer: which may be taken as an instance of the effectiveness of the association between these animals.—EDS.]

VI.—OTTERS AND CROCODILES.

Some weeks ago I went out to Pushkar Lake, which you probably know of by reputation.

The tank is sacred and naturally all shooting is very strictly prohibited. Crocodiles used to abound there living on fish and an occasional stray cow or unwary pilgrim.

As there seemed to be fewer crocodiles than usual that day I asked the care-taker of the lake side house where I was, why the usual numbers were not visible. He told me that they were being killed off by families of *Jalmanus* which had recently come to the lake. Not knowing this name I asked for a description of the animal. At that moment the heads of a family of otters showed up in the middle of the lake and the man pointed them out as the slayers of the crocodiles.

A few days later when I was retailing this tale to some College boys I was interrupted by a boy from Bundi who told me that he had actually seen an otter attacking a crocodile.

This is his story. He was out with His Highness of Bundi and a party late one night shooting fish by the light of a strong searchlight. These fish—variety unknown—but of some considerable size, are apparently attracted to the surface by the beam of light. While out on the lake their attention was drawn to a noisy commotion at some distance from their boat. The beam was directed towards the noise and they saw a crocodile on the surface mouth wide open making a sort of barking noise and on the back of the crocodile scratching and biting at the back of his upper jaw and eyes was a large otter. The boy who told me this story is very keen on Nature study and knows quite a lot about animals and birds. He was very definite about all the details he gave me and said the fight or struggle showed up very clearly in the beam of the searchlight. They watched the struggle for some time and then the otter dropped off into the water and the crocodile sank.

It has struck me that these details may be of interest to some of the members of your society. They are hearsay but with regard to the story from Bundi I can easily ask for evidence of other members of the party who were out that night.

Are otters the natural enemies of crocodiles? The number of crocodiles now to be seen at Pushkar is less than it used to be. The lake is full of fish of the carp variety who are fed by pilgrims. They come up in vast shoals to take parched gram and on two occasions, in my presence, the commotion made by the fish on the surface fighting for the gram has attracted the attention of crocodiles.

The first time a crocodile cruising about some 75 yards from the shoal turned and swam slowly in our direction, eyes just showing above the water. Some 20 yards from the bank the crocodile sank and a few seconds later came up with a rush and swirl, mouth wide open, from under the centre of the shoal not more than five feet from where I was standing feeding the fish. On the second occasion the crocodile adopted similar tactics to begin with but instead of submerging at about 20 yards carried on, on the surface, and when some 4 or 5 yards from the shoal suddenly put on a terrific spurt and sailed into the middle of the shoal mouth wide open.

The tank in a normal winter is about 700 yards long by 300 to 400 yards wide and is surrounded by temples and bathing ghats. In flood the area is trebled.

According to the belief of the natives of the place each female crocodile lays 108 eggs in the laying season—the number of beads in the Hindu Rosary.

MAYO COLLEGE,
AJMER.
July 8, 1938.

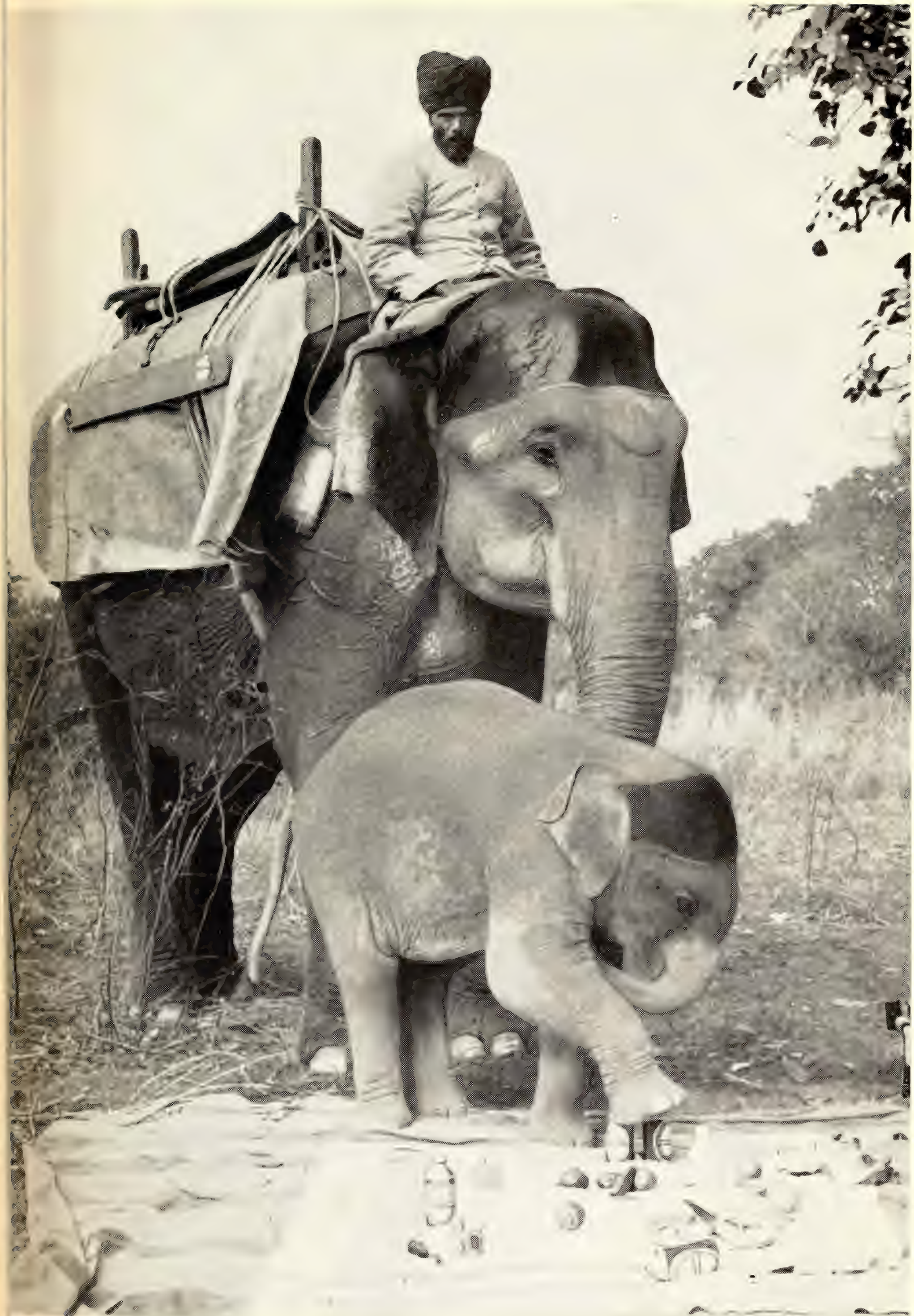
C. HOWSON,
Lt.-Col.

VII.—A BABY ELEPHANT.

A baby elephant produced as a surprise by one of the Forest Department elephants in the Naini Tal district, has been presented to the Zoological Society of London.

Nine months old, after a happy life of adventure, beating in line with nineteen other elephants for birds and big game;—being made a great pet of by the Viceroy's household, when in his camp at Kaladhungi where four tigers were shot;—she has now left her native country, and experiences for the first time in her young life travel by rail and sea.

She travelled down to Bombay with her Mahout in a horse box. There, by the kind assistance of the Bombay Natural History Society, she was put on board a B.I. boat, in charge of Mr. Weeks, one of the officers, with full instructions as to feeding and care,



RAJ PIARI WITH HER MOTHER.

Mr. Weeks and Raj Piari got on very well; he wrote from Port Said to say 'Everything has gone fine and our charge is well behaved.

'She has a walk every morning and follows me all around the ship. We had a very cool and calm run so she was not ill or off her food at all, but we certainly have a job oiling her pads.'

No film star can claim such 'snapping' and success, such petting and publicity; or being such topical news as Raj Piari at the age of from one to nine months.

Her pictures have appeared in many English papers heralding her arrival. There is no doubt that she will be as great a success in London.

On one occasion in a beat for big game a tiger charged right up to her mother, who although untested for staunchness stood her ground unconcernedly while her baby, after one look at the tiger, thought 'safety first', and retired for shelter under her mother's belly.

Her mother Indra Kali was bought at the Sonpur Mela for Rs. 1,500. She had not been in captivity long, and no one knew about the possibility of a family.

She came up to the foot hills of the Himalayas and began work in the forests.

There was great interest among the Mahouts when the unexpected birth took place in Ramnagar.

Very seldom is an elephant born in captivity, although curiously enough, thirty years ago in almost identical circumstances an elephant was born in Ramnagar and sent to the London Zoo.

From the beginning this baby knew no fear. About the size of a boar, she enjoyed chasing the Mahouts' children, who tumbled round her trying to get a ride.

She has never known constraint, going everywhere with her mother. When her mother was chained at the Elephant Camp, Raj Piari was left free. She never went very far from mamma, but at night, to make sure and ease her maternal anxiety Indra Kali used to fasten her trunk round a baby leg, as her beloved slept by her side.

The weaning had to take place very gradually. Mother and child trumpeted for each other. They were separated for a few minutes at a time at first, and then for longer periods, until they ceased to fret. Raj Piari was made a great fuss of and she loved it. Indra Kali was given lots of company of other elephants, and so they parted.

A cable and letter from the London Zoo stating she had arrived in good condition and was eating well and how pleased they were to have her, puts all anxiety aside,—she has evidently carried her 610 lbs. safely and without any hitch to the Pets' corner of the London Zoo.

ARDWELL,
NAINI TAL, U.P.
June 29, 1938.

J. IBBOTSON.

VIII.—CURIOUS BEHAVIOUR OF ELEPHANTS.

In March this year I was after elephant in the Kale Valley in Burma. Having unfortunately badly wounded one elephant I was not entitled to shoot another on my license.

On leaving my camp to go down country, I ran into a herd of elephants in *kyaing* grass on the edge of heavy jungle with thick cane undergrowth.

Hurrying forward, I climbed into a small tree between the elephants and the jungle they were making for; the man with me, a pensioned Gurkha Jemadar, getting up only four feet off the ground. My object was to have a good look over the herd. More than fifty elephants passed within five or six paces of the tree I was in. One elephant only showed signs of unease and let out a minor squeal. At the last a party of eight elephants passed us, but I think must have been suspicious as they turned round and stood round the tree with all heads in; four of them were within one foot of the Gurkha Jemadar, looking directly at him. He was waving the barrel of my small rifle within six inches of the eyes of one elephant, whilst I took aim at the head of another at one foot-range in case of trouble.

The elephants stayed for perhaps five minutes before slowly going off into thick jungle. There was a slight cross breeze at the time.

I wonder why the elephant did not spot us as neither of us kept still, and one elephant looked straight at me at six feet without a sign of recognition of my presence. Any of the elephants could have pulled us off the tree. Perhaps when an elephant is very close with its trunk on the ground, it is unable to get the wind of a man three or four feet up. It is obvious that these elephants made no use of sight or hearing.

BAKLOH, F. W. HASWELL, I.A.,
PUNJAB. *Major.*
May 3, 1938.

IX.—'STAMPING GROUNDS' AND 'SORE NECK' IN SAMBAR.

Mr. W. S. Thom refers in his note in your issue of 15th April, 1937 (vol. xxxix, no. 2) to (*a*) what he calls sambar 'stamping grounds' and (*b*) the sore patch frequently seen on a stag's neck.

In regard to the first there is no longer any doubt that these cleared patches or 'stamping grounds', frequently to be found at the base of a tree or in the open as well, are made by stags during the breeding season.

I have on more than one occasion seen a sambar stag behaving in the manner described by Mr. F. W. F. Fletcher, and have also seen this done by a muntjac (barking deer); and in each case the hinds were close by. To my mind it is equivalent to the dance of the peacock and other birds, in fact a display.

The sore patch on the neck of a sambar stag is very common in South India and the cause is probably glandular. As described, it is generally to be found where normally exists a whorl of hair, but in the case of a stag I shot some years ago the patch was higher up the neck, in the ruff, and the sore was not circular, but elongated. This may have been of course due to other causes.

HONNAMETTI ESTATE,
ATTIKAN—MYSORE P.O.,
S. INDIA.
August 25, 1938.

R. C. MORRIS.

X.—OCCURRENCE OF THE WHITE-HEADED WAGTAIL [*MOTACILLA FLAVA LEUCOCEPHALA* (PRZEWALSKI)] IN THE ATTOCK DISTRICT OF THE PUNJAB.

On April 27th 1938 I shot a male White-headed Wagtail (*Motacilla flava leucocephala*) from amongst a number of *M. f. beema* on passage near Chhoi in the Attock District of the Punjab. There is only one previous record of this bird from India, Whistler having obtained a male at Jhelum on May 2nd 1913 (*Ibis* 1916, p. 75). He informs me that my specimen agrees absolutely with his.

RAWALPINDI,
PUNJAB.
June 12, 1938.

H. W. WAITE, M.B.O.U.
Indian Police.

XI.—EGG STEALING BY KHASIA HILLS CUCKOO (*CUCULUS CANORUS BAKERI* HARTERT).

I have been the witness today, May 14, 1938, between the hours of 3-45 p.m. and 4-45 p.m. of a series of interesting and exciting incidents at a chat's nest in my garden. The nest in question is that of a Burmese Stone Chat (*Saxicola caprata burmanica*) and is situated on a slope of grass land some sixty yards from my verandah, where I command it perfectly with a × 30 telescope, mounted on a tripod.

This nest had four eggs in it, which had been incubated for about four days. Yesterday, May 13, I surprised a cuckoo on the ground within three paces of the nest. This was a female bird and obviously interested in the whereabouts of the chat's nest, so I kept a watch over most of the evening of that day in case she would come to lay. A number of rain storms however came on and I saw nothing more of the cuckoo.

This morning I went to verify the number of eggs in the nest and found the same four eggs in it. I had another look into the nest about 1 p.m. when there were still four eggs.

As I was expecting the cuckoo to come and lay I kept the nest under observation, and sure enough, at a quarter to four o'clock in the afternoon the cuckoo came and settled on the grass slope some three paces below the nest. I had marked the exact position of the nest with a twig and of course with a telescope of × 30 magnification I could see every blade of grass at that distance and the expression in the chats' eyes as they dived and mobbed the cuckoo.

Then a long and protracted fight took place between the chats and the cuckoo lasting on and off for just over one hour!

As I could read the expression of the combatants, it was really an exciting encounter to witness. I was particularly anxious to see the cuckoo lay at this nest as it was an open nest, perfectly accessible to the cuckoo to sit on, and I wanted to see whether she would sit on it, as she has been seen to do in England, or whether she would squirt her egg in and fly rapidly off as I have seen this cuckoo do at an inaccessible nest here. In the former case, sitting on the nest she would close her tail and take some time to lay; and in the latter case she would spread her tail and wings and squirt in and be off within three seconds or so.

The grass in the vicinity was quite short except for a few tufts of longer grass in one of which the nest was situated. This being so the cuckoo was always in full view when near the nest, and through my telescope appeared to be but six feet distant.

The cuckoo was obviously searching for the nest, but the repeated onslaughts of the two chats caused her continually to duck and open her mouth, so that she could not concentrate on her purpose. I could see her peering into the grass everywhere as she hopped in her search some way below the nest. It was apparent that she did not really know its exact situation. This hopping about and mobbing of the intruder went on for a considerable time. It was quite obvious she had no egg in her throat by the sudden twists of her head and the opening wide of her mouth at the attackers.

The cock chat was doing most of the mobbing, and indeed was doing some damage to the cuckoo. I noticed he knocked a feather out of her back, and soon afterwards I saw the little hen chat pick it up off the grass and fly off with it!

The hen chat would often go and sit on a twig just by her nest and I could not make out why the cuckoo was so slow in finding it. The battle went on fast and furious, the cuckoo hopping about, and often when she fell over she had to spread her wings to regain her balance. Eventually she flew up onto the wire railings three or four paces beyond the nest. Another chat now joined in the attack—a young bird of the year.

While the cuckoo was perched on the railings within such a short distance of the nest, the hen chat actually went back to her nest and sat on it. I thought then that the cuckoo could not fail to have exactly located it. I could see her peering at the place. Now she came down and the battle was renewed, but she was unsuccessful again and was driven off. She returned and gradually worked her way up to the nest, losing some feathers from the back of her head in the final assault. She got to the nest this time and dived straight at it, thrusting her head in and was off in one second! She had not spread her tail, and it was obvious that she had not laid. Her action was so rapid that I could not see whether she had flown away with an egg or not. I continued to wait, noting that the battle had so far lasted 20 minutes.

As I thought she had flown off, I left my house and walked slowly down the garden to inspect the nest. Half way down however I saw the cuckoo sitting on top of a willow tree some ten yards from the nest, so I returned quietly to continue my watch through my telescope from the verandah.

As she now knew the position of the nest, I hoped she would come and lay. At the same time I knew the chat's eggs were not quite fresh and so not suitable for that purpose.

The cuckoo waited some ten minutes on the willow tree and then she flew down and settled in a small bush within five paces of the nest and below it. The chats at once began the attack. Soon after the cuckoo came to ground and began hopping up towards the nest. She was savagely attacked and was not having it all her own way. It took her a considerable time to reach the nest under the continual mobbing, which became more and more severe as she got nearer and nearer to the nest.

When she did reach it this time, she dived in as before, but spread her tail to half extent, keeping it more or less horizontal and not pressed down as in the laying position. She was but a second at the nest and then she flew off with an egg very clearly seen in her bill, pursued by the angry chats.

A pause of perhaps five minutes followed. I could not see the cuckoo and I did not know in which direction she had gone. She returned after a short time and the battle was renewed. She eventually reached the nest again and dived in with half-spread tail and was gone in two seconds! As again her tail had not been depressed and her stay at the nest had been so short I considered that she had not laid.

She flew off this time to a considerable distance without giving out the bubbling notes that a cuckoo usually gives out after laying. I decided the time had come to walk over to the nest and investigate matters. On reaching the nest, I saw *one* chat's egg in it! So the cuckoo had taken three eggs. That she had not laid I attribute to the fact that the chat's eggs were some four days incubated. Several of the cuckoo's feathers were scattered about near the nest.

The little hen chat had from time to time given away the position of her nest, though I cannot think that it was done deliberately, seeing how fiercely they had both attacked the cuckoo. At one time she went back and sat on her nest when the cuckoo was *within four paces of it.* When she was on her nest she was just hidden from view in the grass. I was amused to see her head suddenly appear on one occasion as she looked out anxiously at the cuckoo hopping up from below, then she ducked her head and continued to brood her eggs.

This account will show how a cuckoo will persist over a whole hour at a nest, and how she will take the eggs if they are not fresh ones suitable for her purpose by returning time after time to steal them. Finally, it may be noted that no male cuckoo put in an appearance to assist her the whole of the time these incidents were under observation.

That cuckoos lay their eggs not in the early morning as most birds do, but in the late afternoon or evening, is perhaps a part in the adaptation that the cuckoo has perfected against its dupes, for in the fading light the cuckoo's egg stands a better chance of acceptance.

It has not yet been shown that cuckoos eat birds' eggs indiscriminately. I believe they only take away and eat the eggs of those species of small birds they are habitually parasitic on, and that there is *very good reason for this,* for by so doing they prevent their intended fosterers from sitting and hatching off their young, and cause them to start nesting operations all over again and so provide suitable fresh eggs for them to lay with.

It is hardly credible that a cuckoo would battle for a whole hour with two angry chats merely in order to eat their small eggs—the reward would not justify the trouble involved. We must look for some more cogent reason, such as the one I have suggested.

Sixty yards beyond this chat's nest and outside my compound fencing I found a chat's nest about a week ago.

The chat flew out at my feet, and on looking into her nest I saw a young cuckoo in the nest and fallen outside two of the young chats. They appeared to be about six days old and their pale yellowish colour contrasted with the black skinned young cuckoo in the nest.

It was a curious coincidence in finding the nest at the very moment the young cuckoo had kicked the young chats out. The young chats were upside down struggling and about 8 inches apart. They had fallen down the sloping bank a foot or so.

Knowing what their fate was bound to be if I put them back in the nest I took them off and put them in another chat's nest in my garden which had two hard set eggs in it. Even then however they met an unkind fate for 2 days after they had mysteriously disappeared.

TAUNGGYI, T. R. LIVESEY.
S. SHAN STATES, BURMA.

XII.—CALL NOTES OF THE BURMESE PLAINTIVE CUCKOO (*CACOMANTIS MERULINUS QUERULUS*).

I have seen no account of the call notes of this bird and so I would like to put on record what I have been able to make of them from observations over several years. The notes are probably very similar to the notes of the Indian race the notes of which appear to me to be inadequately, and possibly wrongly, described in the *Fauna*.

The characteristic, plaintive cadence-call—from which this cuckoo has derived its name of 'Plaintive Cuckoo'—is very well known, but it has two other distinctive calls that have not, I think, been described. Then it remains to consider what the meaning of these call notes are, and by what sex they are uttered.

The first, and best known, is the cadence-call which may be syllabified as follows:

'Tēe-tēe-tēe-tēe-tĭtă-tĭtă-tĭtă-tēē'

The first four notes are plaintive, and prolonged over a period of about two seconds each, with an interval of about three seconds between each. The next three notes are double ones, twice as fast, and with about one second between each—and the final 'teē' is rather prolonged and mournful—say over three seconds. The whole 'song' is a plaintive cadence down the scale.

This is the call of the cock bird telling the hen what a very fine fellow he is, and is usually emitted from a high perch. It may be compared to the 'cuckoo' call of *Cuculus*. Like the cuckoo too, the cock Plaintive Cuckoo seems to be on tour round the country, flying from tree to tree—calling—and passing on. He seems to have no regular beat which, as in *Cuculus*, suggests that they too are indiscriminate in their mating.

This cadence-call is often uttered at night—and over long hours, sufficiently so to annoy anyone trying to get to sleep. After each call there is an aggravating pause, as with the Hawk Cuckoo, and one waits for the beginning of the next call, which may come at any time. It is difficult to ignore it. It is made on dark nights as well as on moonlight nights, and that suggests that these birds can see at night—at any rate well enough to dodge the owls.

Sometimes the first two notes only are uttered—and so the call shortened, but only to be resumed in full later. At the beginning of the season, and at the very end, imperfect call notes are emitted as in *Cuculus*—before the bird gets into full voice, and again when he is 'sung out' at the end of the season. This cadence-call is only uttered in the breeding season.

The second type of call note is in contrast to the cadence-note, a call in the *rising* scale and quite different in every way. It is a cheerful little call and is made by the same sex that calls the cadence-call—that is to say the cock. It is uttered all through the year.

It may be syllabified as follows:—

'Twēēt-tā-twēē . . twēēt tā-twēēt . . twēēt-tā-twēēt'.

The first note prolonged—over say, four or five seconds, then at once follows the second part of the call, over one second and then two seconds. The whole will be seen to consist of three calls and the interval between each is not regular but is usually with an interval of some five seconds. Sometimes only one call of 'twēēt-ta-twēēt' is given. The whole three calls are in a rising scale and somewhat piercing in character and may be heard a long way off.

A cock bird will emit the cadence-notes and then often switch onto this rising and cheerful call. They may alternate these calls.

Whether the hen bird gives this call note, or not, I cannot say, as I am averse from shooting a calling bird to satisfy my curiosity. I have not however observed a bird in the brown, barred plumage make it, and it may be that this call is confined to the cock bird.

Perhaps the meaning of this call is 'Here I am—here I am—here I am'. That is how I am inclined to interpret it.

I have not heard it uttered at night.

The third note is in the nature of a harsh screech and is nearly always emitted in the undergrowth or thick cover. It may be described as:—

'Tchree—tchree—. . . tchree tchree'.

It is usually uttered three or four times, but is quite irregular. It sounds rather like an alarm note but I do not think it is. *Cuculus* does not appear to have an alarm note and these small cuckoos seem to have very similar habits to *Cuculus.*

I have heard this screech call uttered by birds in the usual plain plumage, but I cannot say whether they were cock birds or hens. It is the characteristic call however of the brown, barred-plumaged bird. There is a good deal of mystery about these brown birds that somewhat resemble the Bay Banded Cuckoo. (Their skins were mixed up and confused in the British Museum.) It is sometimes referred to as the 'juvenile' or 'immature' plumage of the Plaintive Cuckoo, but the only two birds I have shot appeared to be old birds, and both were females with clusters of eggs in them.

I should like to know if all these brown birds are females—or not; and also what their age is. I am inclined to think that they are females and represent the so-called 'hepatic' females in *Cuculus.*

Perhaps this screech call is the call of the hen bird only and corresponds to the 'bubbling' call note of the female *Cuculus.* Any further information on the subject will be very welcome by the writer and others interested. I have never heard the brown bird utter the cadence call note—nor the 'Tweet-ta-tweet' call.

That, briefly, describes the three types of call notes, but it is apparent that there is more to discover in connection with them.

Particular attention is drawn to the call notes of the parasitic cuckoos since a knowledge of their calls is essential in the fascinating study of the many problems they set us in their parasitism. It is not known for instance how these tiny Plaintive Cuckoos get their eggs into the nests of the small birds they victimise. It has been suggested that they may hover over the nest and drop their eggs in, but that would be quite impossible in the case of nests of tailor birds and warblers (*Franklinia*)—the commonest fosterers in this area. Such nests are invariably overhung by the green leaves they are sewn into and they are moreover in thick undergrowth. They probably squirt the egg in as I have proved to be the case with *Cuculus,* when confronted with an inaccessible nest, but even that would call for an acrobatic balancing that is almost incredible. If they are eventually found to put their eggs in *with the bill* it will come as a very great surprise indeed—for such a method has never been known to have been made use of by any parasitic cuckoo.

TAUNGGYI,
S. SHAN STATES,
BURMA.
June 1, 1938.

T. R. LIVESEY.

XIII.—THE SHAN BROWN WOOD OWL (*STRIX INDRANEE SHANENSIS* BAKER).

This very fine owl was first obtained by me at Sintaung some fifteen miles to the south of Taunggyi in 1933, at an elevation of about 6,000 feet. A young one just able to fly was secured and an old bird which unfortunately had her wing broken by a Taungyo who struck her with a stick as she came out of a rocky cave. I kept these birds in captivity for some time and then Mr. Carrott of Maymyo kept them.

Eventually the skins were sent to Mr. Stuart Baker who described them in the *Ibis. Bulletin*, no. cccxc of Nov. 23, 1935 and named them suitably '*shanensis*'. The cowl of this owl is darker and the throat patch of white, more extensive than in the other two races.

Subsequently—last year—I had two more in captivity from the neighbourhood of Taunggyi where these owls may be heard calling sometimes up in the crags. After studying them for some months I released them on the Taunggyi crags.

This year, on February 17, a Taungthu brought two eggs to me that appeared to me to be the eggs of this owl and so next day I rode out with him to the place where he had secured them. As the nidification of this owl has not yet been described the following account is of interest since it is almost certain that the nest and eggs found were of this new subspecies.

I rode out about six miles from Taunggyi and at approximately an elevation of 4,700 feet we came to a secluded nala which was well wooded and about half a mile under a limestone precipice. The Taungthu ascended the nala till he came to a large peepul tree and then he pointed out to me the hole some twenty feet up from which he had obtained the eggs on the previous day. Unfortunately the parent birds were not at home. I sent him up to examine the hole again. He reported that there were no pellets inside or stray feathers, nor could I discover any at the foot of the tree. We then worked our way further up the nala hoping to catch sight of the owls. Some two hundred yards up the hill side one of the owls came back over the nala but against the light, and in the thick jungle I was not able to make certain of its identification. It appeared to be a Brown Wood Owl.

The only other big owl I know of in this neighbourhood is the Fish-owl but this particular locality was too dry for that species and the Taungthu assured me the parent bird had dark eyes.

The two eggs are beautifully shaped and of even and close texture. There is a satin like gloss and no signs of excrescences anywhere on them. There are however some faint longitudinal undulations to be seen. The eggs measure—

54 × 44 mm.
52 × 44 mm.

Taunggyi,
Burma.
May 10, 1938.

T. R. LIVESEY.

XIV.—NESTING OF THE BOOTED EAGLE (*HIERAËTUS PENNATUS* [GMELIN]) IN THE SIMLA HILLS.

As authentic records of this bird's breeding in India are very few I venture to send you an account of a nest I took this year.

My shikari while out looking for butterflies on the previous day had found a nest which he assured me belonged to a hawk of some kind which was unknown to him.

On the following day, 10th May, I went with him to investigate. The locality I found was a quiet, secluded nullah in an extensive Deodar forest facing N.-W. The nest was placed on an horizontal branch 3 feet from the main trunk and 75 feet from the ground of this very fine Deodar (*Cedrus deodara*). The structure was composed entirely of Deodar and the prickly Berberis sticks with a lining of fresh foliage of Deodar. Littered about the edge of the nest were a few doves' and pigeons' feathers and a head of each of these birds. Other feathers of the same were lying on the ground in the vicinity of the nest. There were two highly incubated eggs of a pale skim-milk, faintly and evenly stippled and blotched with pale rusty red.

The elevation of the nesting site is 6,000 ft.

The bird made little demonstration. After leaving the nest she flew to an adjacent tree whence she uttered a sharp scream from time to time.

That this is a regular breeding species in these hills I have long suspected, having sight records of it on various occasions during the months April, May and June. To the ordinary observer it would be passed over as a Kite (*Milvus m. govinda*), but I think it is very rare as a nesting species in the Himalayas.

Simla.
July 13, 1938.

A. E. JONES.

XV.—THE NIDIFICATION OF THE BURMESE BARRED-BACK PHEASANT (*SYRMATICUS HUMIAE BURMANICUS*).

The nidification of this lovely pheasant—the eastern race of Hume's Pheasant—has not yet been described, so it gave me great pleasure to secure a full clutch of eggs this year from the neighbourhood of Taunggyi.

On April 6th a Taungthu brought me seven eggs together with the hen bird alive. I placed it in my aviary, but it had such injuries to the top of its head from plunging about in the bamboo basket in which he brought it that it survived but a few days.

For identification I have kept the tail and lower back which is sufficient in view of the district in which it was secured.

The Taungthu described the nest as having been situated on the top of a small bank by a hill stream in forest, and from the locality pointed out to me, which is some six miles from Taunggyi, the elevation would be about 5,000 feet. The eggs remind me somewhat of francolin's eggs in shape, and character and proved to be very stout shelled. They are like the eggs of Hume's Pheasant so well described by Mr. Stuart Baker in his *Nidification of Birds of the Indian Empire.* They are however smaller than those of that bird.

They measure—

47 × 34 mm.; 45 × 34 mm.; 45 × 34 mm.; 45 × 33 mm.; 46·3 × 34·5 mm.; 46·3 × 34 mm.; 45 × 34 mm.

It was a full clutch apparently since they were slightly incubated.

These lovely birds were some years ago to be found on the forested crags over Taunggyi but since the Forest Service destroy by fire annually this wooded hill, birds of all kinds have become scarce and I need hardly say water too. The systematic firing of all jungle in this neighbourhood and the increase in the herds of half starved cattle have reduced this lovely part of the Shan States to a wilderness. Erosion of every kind is going on to such a lamentable extent here that yearly agriculture becomes more and more heart-breaking and wild life more and more scarce.

TAUNGGYI,
BURMA. T. R. LIVESEY.
May 10, 1938.

XVI.—AN EXTENSION OF THE RANGE OF THE WESTERN HORNED PHEASANT (*TRAGOPAN MELANOCEPHALUS* [GRAY]).

Reference your letter dated 27th July, 1938.

The Tragopans were found in the Duber Valley of the Indus Kohistan (right bank) and brought to the Wali in the Spring of 1938. Three eggs were also brought to the Wali lately. The Wali of Swat states that there are a few specimens west of the Indus and that only two specimens have been found in the Swat River Basin during living memory.

MALAKAND, E. H. COBB, *Major,*
August 3, 1938. *Political Agent,*
DIR, SWAT AND CHITRAL.

[Recently, we received three skins of the Western Horned Pheasant (*T. melanocephalus*) for mounting from Swat State. As we were interested to know the locality the birds had been obtained from, we wrote to Major E. H. Cobb, the Political Agent, for further particulars. The above letter was the reply. According to the *Fauna*, 2nd Ed. the distribution of this species is given as 'From the west bank of the Bhagirathi River in Garhwal to Kashmir and Hazara'.—EDS.]

XVII.—GAME BIRDS IN THE ANAIMALAI HILLS AND THE SOUTH COIMBATORE DISTRICT—A CORRECTION.

(*Published in vol.* xxxix, p. 732).

I understand from friends who have connections in the Nilgiris that the alleged abundance of Fantail snipe in this area has caused comment and argument amongst a number of snipe shikaris there.

I based my identification of the Fantail and the Pintail snipe on the information given in Stuart Baker's *Game Birds of India*, volume ii. It is possible the identification may be wrong. To settle any doubt I will send you specimens for identification, but this will have to wait until next season as I am unable to use a gun at present and most of the snipe have left. Both of these snipe are found up here and in the country at the foot of the hills. One is common the other is uncommon.

As regards the statement that I had seen a mallard I am sorry that I included this note in the article. The record is unsatisfactory and lays itself open to the charge of mistaken identity. Mention of several other ducks was left out for this very reason but this one crept in without being noticed. I am quite certain in my own mind that the bird was a mallard and this led me into a reference which I should have avoided. If and when a mallard is shot here I will send you the skin.

MONICA ESTATE,
VALPARAI P.O.,
S. INDIA.
April 22, 1938.

J. WILLIAMS.

XVIII.—BREEDING OF PINTAIL SNIPE (?) IN BELGAUM DISTRICT.

On May 5th I received information from a shikari that some snipe had been seen at a certain place in the Belgaum district. Being rather sceptical of the truth of the report I went out to investigate and to my considerable surprise saw the birds myself. From their behaviour they obviously intended to remain in the locality and on enquiry with the local natives I was informed *that nests and eggs had been regularly found there in previous years, chiefly in the month of July.* Without actually shooting a specimen it was impossible to tell the exact species. But as they were found on dry, newly ploughed rice fields I should say they are pintail. This is borne out by the fact that the first snipe to be obtained in this district in the shooting season in early September are almost invariably of this species.

In this case the nests are said to be made in the long grass on the bunds of rice fields. As in the standard reference books no mention is made of snipe remaining to breed in this part of India I am writing to enquire whether this is generally known to be the case. There can be no question of the birds being incapacitated and unable to migrate since as many as a dozen were seen in this particular neighbourhood, which incidentally is an intensely cultivated and well populated one. Since there are many other such suitable localities in the district there seems no reason why they should not breed fairly widely in these parts.

BUNGALOW NO. 51, O. H. DE ST. CROIX.
CANTONMENT BELGAUM.
May 6, 1938.

XIX.—BIRD NOTES FROM THE DRY ZONE OF UPPER BURMA.

So little is on record of the birds of the dry zone of Upper Burma since Macdonald wrote of Myingyan (*J.B.N.H.S.*, xvii, 1906 and meads of the Chindwin (*idem*, xviii, 1907) that I venture to record some notes made during two short trips through parts of the Shwebo and Sagaing districts in December 1931 and June 1936. I have not recorded a full list of the common birds seen. In December 1931 I marched from Wetlet to Shwebangon and down the newly canalised area to Thazin at the south end of the great Halingyi Lake. In June 1936 I spent two days on Wetlet Lake in Shwebo. On this occasion, the water was remarkably high. The huge bulrush beds of the lake were being harvested, which must have greatly disturbed their commonest occupants, the Yellow Bittern and the Purple Gallinule. I got the impression the ducks had not yet commenced to nest. One note recorded below was made at Maymyo (4,000 ft.) on the edge of the dry zone.

1. **Argya gularis.** White-throated Babbler.

It was interesting to note that, despite the flooding of large new areas by the extension of the canal zone, both this species and *Mirafra assamica* so typical of dry sandy country, still cling to the thorn-bushes fringing the canal though cornland stretches for miles on both sides. One would have expected both species to have moved elsewhere.

2. [**Acrocephalus stentoreus ?** Great Reed Warbler?

I *thought* I saw two or three in the big reed-beds far out on Wetlet in June but was never sure. I certainly never heard a Reed-Warbler of any species singing.]

3. **Prinia flaviventris flaviventris.** Yellow-bellied Wren-Warbler.

Many were seen on Wetlet in June, some a long way from land. Two specimens were obtained and identified by Dr. C. B. Ticehurst.

4. **Mirafra assamica.** Burmese Bush Lark.

See no. 1 above. Still common in the narrow fringe of thorns along the canal.

5. **Butastur teesa.** White-eyed Buzzard Eagle.

Said in the *Fauna* to be found 'throughout north and western Burma', it seems to be in Burma largely a dry zone bird, though Armstrong and Davison recorded it from Thaton. The only place in which I have found it was near Shwebangon (Shwebo) in December 1931 when I saw several. The general appearance in flight is very pale. When at rest, the head is very falcon-like and the white patch on the nape is noticeable. It has a quick lilting flight.

6. **Streptopelia decaocto.** Indian Ring Dove.

The *Fauna* gives its distribution as 'all Burma'. This is probably wrong as Oates never got any south of Thayetmyo. It is almost certainly a dry zone bird. I saw a number in thorn-jungle on the edge of the canal and near Shwebo. The pale grey tail and yellow skin round the eye are distinctive characters in the field.

7. **Coturnix coromandelica.** Black-breasted Quail.

Common and calling all night in December in crops near Shwebo.

8. **Gallinula chloropus.** Moorhen.

One or two pairs on Wetlet in June 1921. I found a nest with one egg in it. All the breeding records of this Moorhen seem to be from central Burma and further observation is desirable on this bird's status in the province. In Myitkyina it appears to be a winter migrant.

9. **Gallicrex cinerea.** Watercock.

One pair seen on Wetlet in June and others heard. It would be interesting to know whether this curious and little-known bird is resident or a rains-immigrant.

10. **Porphyrio poliocephalus.** Purple Moorhen.

Abundant in the bulrush beds. I found no nests and they probably suffer much at this season from the bulrush harvesters.

11. **Hydrophasianus chirurgus.** Pheasant-tailed Jacana.

Many on Wetlet on June 21-22, apparently not yet breeding. They were in full plumage and usually sitting out on the open water, with their long tails held up in a curve clear of the water. I could find no trace of a nest.

12. **Rostratula benghalensis.** Painted Snipe.

In June 1932, when the Maymyo lake was nearly dry, several pairs of Painted Snipe undoubtedly bred there. On June 19 I saw a male with three small young ones crossing a patch of mud, and caught a brood a few days later, the male bird scrambling and fluttering about close to me.

13. **Burhinus oedicnemus.** Stone Plover.

A large gathering seen on some fields near Wetlet on June 22nd.

14. **Glareola maldivarum.** Large Pratincole.

Several, apparently with young, on the cultivated land west of Wetlet Lake on June 21.

15. **Lobivanellus indicus.** Red-wattled Lapwing.

A party were seen on June 22nd flying high along the edge of Wetlet from the north. It is so unusual to see these very sedentary birds flying at any height above the ground that it seems possible that they were migrating.

16. **Anhinga melanogaster.** Indian Darter.

The local name is '*U-ban*'. Only seen in December and not apparently breeding. (I saw no signs of nesting cormorants and only *Phalacrocorax niger* in June.)

17. **Pelecanus crispus.** Spotted-billed Pelican.

Several on Wetlet on June 21, some of which seemed to be immature. It is remarkable that no one has discovered Pelicans breeding in Burma in the last 40 years. Though such ungainly looking birds, they can turn on their own axis with amazing speed and rise off the water in three strokes.

18. **Ibis leucocephalus.** Painted Stork.

The Burma records of these conspicuous birds are remarkably few. It is not, I think, any longer 'very abundant in Southern Pegu' (Oates) and practically all the records are from the dry zone, though it does not seem to be known where it breeds. I saw seven or eight adults and one immature bird on Wetlet on June 22.

19. **Dissoura e. episcopus.** White-necked Stork.

20. **Xenorhynchus asiaticus.** Black-necked Stork.

I saw a few on both occasions but no signs of breeding. There seems astonishingly little on record in Burma of the breeding of both these large and easily-observed birds.

21. **Ardea purpurea.** Purple Heron.

A few on Wetlet in June but I could find no nest.

22. **Ardea cinerea.** Grey Heron.

Saw a very large gathering of 50 or 60 on Thazin in December, and one pair on Wetlet in June. I can only find two breeding records in Burma (Macdonald's in Myingyan), and my own in Henzada.

23. **Sterna albifrons sinensis.**

I shot an immature bird out of a small party on Wetlet on June 22. No other Terns were seen and there were no signs of any *Chlidonias* nesting.

24. **Tringa erythropus.** Spotted Redshank.

A very large flock on Thazin in December.

25. **Bubulcus ibis.** Cattle Egret.

Common, no nesting colony seen.

26. **Egretta g. garzetta.** Little Egret.

Common, no nesting colony seen.

27. **Ixobrychus sinensis.** Yellow Bittern.

The common bittern of the Wetlet jheel in June and apparently breeding in the big bulrush swamps, though I failed to find a nest. Numbers were seen flighting to and fro and many were flushed from places where they clearly spent their time clambering from rush to rush. Like the Chestnut Bittern, they are not shy or crepuscular at this time of year.

28. **Ixobrychus cinnamomeus.** Chestnut Bittern.

Two or three pairs breeding on Wetlet. Flushed one pair off a very *kutcha* nest with one egg in bulrushes.

29. **Nettapus coromandelianus.** Cotton Teal.

In large parties on Wetlet on June 20, apparently of adults.

30. **Dendrocygna fulva.** Large Whistling Teal.

Several seen, nearly all in pairs, on June 22. The larger of the two Whistling teal seems to be mainly a bird of Central Burma. I have never seen any in Myitkyina and few in Lower Burma, and the records, what there are, suggest it is a dry zone bird.

31. **Anas poecilorhyncha.** Spotbill.

A good many seen in pairs and small parties which had probably not yet commenced to breed (cf. Macdonald, *Journal,* xvii, 503).

32. **Podiceps ruficollis.** Little Grebe.

Local name: 'On-salank'.

Very common: Saw several nests with clutches of two to five eggs some very imperfectly covered up.

KINGSCLERE. J. K. STANFORD.
April 1938.

XX.—SWIFTS IN SWALLOWS' NESTS.

Every one is aware of the manner in which cuckoos, well-known in Europe as in India, claim the services of foster parents to rear their young, and of the extraordinary complacency with which the foster parent submits to this form of parasitism. It seems one of the most remarkable things in Nature that although cuckoos are often mobbed and driven off by small birds such as pipits, yet there is no recorded case of a foster parent turning out a cuckoo's egg or refusing to feed the young cuckoo after hatching. On the other hand, it is believed that in many instances the cuckoo when planting her egg in the nest removes one of the foster parent's eggs. In India there are several species of cuckoos and the same inexplicable complacency on the part of the foster parent is observable in all.

There is also the robber, who steals other birds' eggs from their nest for eating purposes. I spent an amusing half-hour recently watching a battle royal in a thorny acacia tree. A tree-pie was sitting beside a dove's nest containing two eggs. The nefarious intention of the tree-pie was manifest, but there were some 30 or 40 smaller birds hopping, squealing, pecking round it, robins, magpie robins, bay-backed shrikes, king crows, ubiquitous mynahs and even a few sparrows. Curiously enough, neither dove was anywhere to be seen. The dove is a coward compared with most birds when it comes to protecting its eggs or young. Eventually the tree-pie, not daring to take the eggs with so much hostile demonstration, flew away discomfited and after an interval of time the timid dove reappeared and settled peacefully on her eggs.

Then there is the lazy type of bird which commandeers other birds' nests. It is comparatively common for certain species to use the old nests of other birds. The kestrel frequently uses old crows' nests, or in Europe, rooks' nests. I once found a kestrel lying dead on the edge of a rook's nest with two of her eggs in the nest. It was in a rookery situated on the artillery and machine gun practice ranges on Salisbury plain and the kestrel had been killed by a stray machine gun bullet. The common mynah is very partial to building up an old crow's nest. Even the peafowl is occasionally not averse to making use of an old vulture's nest and the various species of falcons quite commonly use old nests. But these are disused nests for which the original builders have no further use.

There are, however, some birds bold enough to thieve the newly built nests of another species. I watched one day on a sunny afternoon in England a most amusing contest between a starling and a green woodpecker for possession of the newly-excavated nest hole of the latter. Once the starling was inside the woodpecker was powerless to evict him.

Recently in India I have been watching the swallows and swifts in the Siwalik hills 8 miles from Dehra Dun and I have discovered what appears to be wholesale robbery on the part of the swifts. There is a large number of bridges and culverts under the road which runs through these hills and the majority of these serve as breeding places for the Red-rumped Swallow (*Hirundo daurica*).

Early in July I had seen these swallows flying in and out through the arches and had watched their characteristic retort-shaped nests being constructed, with their rounded egg-chambers lined with grass and feathers and the tubular entrance 5 or 6 inches long. On looking again at these nests after 10 days or so, I found them occupied in 80 or 90 per cent. of cases by the Common Indian House Swift (*Micropus affinis*), with the white rump, white throat and chin and square tail. At first I could not understand the meaning of this. I had never heard of swifts building these retort-shaped nests of mud. Nor were these nests built in close apposition as are usually the swifts', in no case did I find more than two nests in any one arch or culvert and then those two were widely separated from each other. Yet in many instances I actually took the typical adult swift from the nest by hand and examined it before letting it fly. I also later examined several of the young birds. Although I never actually saw the red-rumped swallows at the nests applying mud, yet I frequently sat on the parapet and watched these birds collecting mud from a nearby puddle and flying under the arch, there being no swifts in sight near the locality, and then 10 days or later found these nests occupied by swifts. There can be no doubt that the swifts made a habit of purloining the red-rumped swallows' nests as soon as they were completed. It seems that now, at the end of July, the red-rumped swallows are coming into their own, for a survey made on 30th and 31st July shows that new retort-shaped nests are now occupied by their rightful owners, both young and new-laid eggs being found, and the swifts appear to have finished breeding in these situations and have mostly departed probably for villages and cities where more flies can be obtained. It seems remarkable that a species no bigger than the swallow itself can oust it from its own nests in this wholesale manner, yet after a month's observation I have not the slightest doubt of its reality.

It would be interesting to know if any other forms of robbery or vandalism in bird life have been observed.

DEHRA DUN. KENNETH COMYN,
July 31, 1938. *Colonel.*

XXI.—ON CUCKOOS IN SUGAON, CHAMPARAN DISTRICT, BENGAL.

It may interest you or your readers to hear that while birds' nesting in a 'garchie' in village Sugaon on the 12 June I came across 6 eggs in the nest of the Common Babbler (*Argya caudata*)—4 Babbler's, 1 Hawk Cuckoo's (*Hierococcyx varius*) and 1 Pied Crested Cucukoo's (*Clamator jacobinus*)—and 2 nests of the Paradise Flycatcher (*Terpsiphone paradisi*) with 3 eggs in each—2 their own and one of the Indian Cuckoo (*Cuculus micropterus*) in each.

The cuckoo's egg was exactly the same colour as the Paradise Flycatcher's only at least twice as large and very much like some of the eggs a King Crow (*Dicrurus*) lays. This is the first time I have found this bird's eggs.

This 'garchie' seemed a very popular one for I found no less than 26 nests there—Babbler, Golden Oriole, Chestnut-bellied Nuthatch, Purple Sunbird, King Crow, 5 Paradise Flycatcher, 1 White-browed Fantail Flycatcher, 7 White Eye, 1 Magpie Robin, 1 Tree-pie, 1 Little Minivet, 1 Iora, 2 Red-vented Bulbuls, 1 Common Mynah and 1 Spotted Dove.

By Hawk Cuckoo I mean the *'Ive feel it'* or Brainfever bird, by Pied Crested Cuckoo—what we call here the *'Rainweather'* bird as it arrives just before the rains.

By Indian Cuckoo I mean *'Who stole that book'—'Want more Pekoe'—'Go Calcutta'.*

I heard the European Cuckoo twelve times in my compound last week—this only the 3rd time I have heard him in the plains in 33 years!

TURKAULIA P.O.,
B.N.W.RY., F. A. C. MUNNS.
CHAMPARAN.
June 14, 1938.

XXII.—A COMMENT ON THE NAME 'BLOODSUCKER' APPLIED TO [*CALOTES VERSICOLOR* (DAUD.)].

Mr. McCann in his notes on *Calotes versicolor,* published in the issue of 15th December of the *Journal* of the Society has rightly deplored the name 'Bloodsucker' applied to the Calotes lizard. This misnomer might have originated through a popular superstition prevalent in many parts of India. I have met with this superstition in such distant parts of India as the Malabar district in Madras and the Birbhum and Burdwan districts of western Bengal. Common people believe that the Calotes lizard has the power of sucking a person's blood by simply looking at him. It is also believed that the Calotes changes into red colour due to the effect of the blood it has absorbed by staring. This superstition is the cause of very great persecution.

As to the name 'Chameleon', I know from personal experience that the tendency to apply this name to many members of the lizard family is common in other parts of the world too. South American Iguana lizard skins are known as Chameleon skins all over Europe and North America.

The habit of frequently ducking its head has brought further misfortune to the Calotes. I had noticed that the uneducated Mahommedans in Bengal never fail to kill a Calotes, when met with. When killing is impossible they throw at least one stone at it. On my enquiring, the following explanation was offered. The Prophet while flying from his enemies took shelter in an old well. His pursuers on approaching the well saw a Calotes lizard at the edge ducking its head. They interpreted it as an indication that some-body was hiding there. I do not know whether this belief exists among the Mahommedans in other parts of India.

KHAR. BOMBAY 21. B. BASU.
April 24, 1938.

XXIII.—EXTENSION OF THE RANGE OF THE MOTH *NORRACA LONGIPENNIS* MOORE (*NOTODONTIDAE*).

I have lately taken a moth that appears to me to be a specimen of *Norraca longipennis,* Moore—Hampson's vol. i, page 137.

The range of this species is given as Ceylon, Penang. Would you kindly inform me if the range of this moth has been extended since the publication of the work?

RAJGHAT CONCERN, A. C. HARMAN.
P.O. BETTIAH,
CHAMPARAN.
June 15, 1938.

[The specimen referred to by Mr. A. C. Harman was received and on examination was found to be a male of *N. longipennis.* There are also a male and female of this species in the Society's collection, collected by Mr. T. R. Bell at Belgaum, on the 20th October 1906 and 15 September 1910 respectively.—EDS.]

XXIV.—DESCRIPTION OF THE LARVA OF *ETERUSIA* (*SORITIA*) *LEPTALINA* KOLL. (*ZYGAENIDAE*).

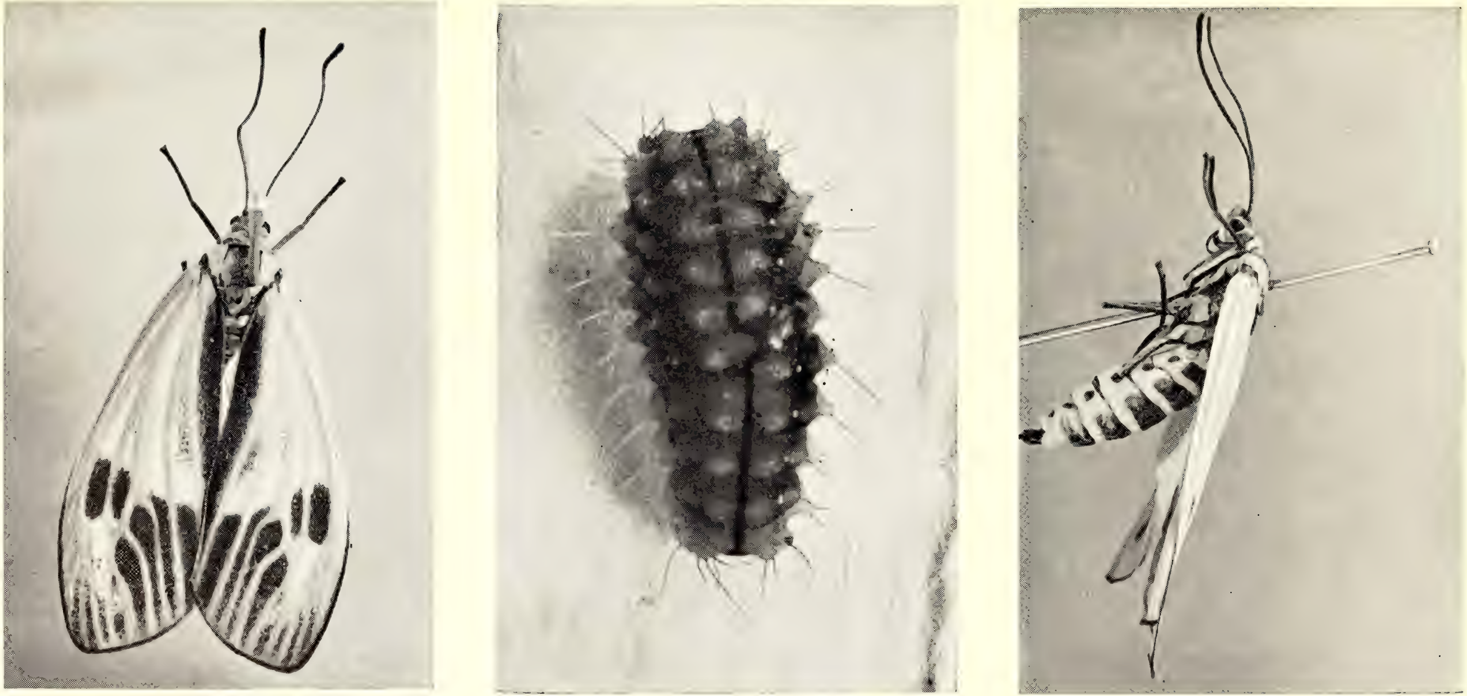
(*With a plate*).

I have sent photos of a female and larva of the Zygaenid moth *Eterusia leptalina.* The moth (imago) is common here but I do not think the caterpillar has been previously described. It is umber brown in colour, covered evenly all over the upper surface with hairs of 8 to 10 mm. in length.

Col. E. A. Glennie and I found the larvae feeding, singly, on the foliage of the 'Raspberry' (*Rubus macilentus*), order *Rosaceae.* The cocoon is of a peculiar flat surface; the silk 'isabelline' and the whole structure has the appearance of a fungoid growth.

SIMLA. A. E. JONES.
November 3, 1937.

[As far as we are aware nothing is known of the life-history of this moth. It occurs in the Himalayas; Sylhet; Bernardmyo, Burma. The life-history of an allied species was described in vol. xviii, p. 430 of the *Journal—Heterusia magnifica* Butl.—EDS.]



Eterusia leptalina (Koll).

XXV.—DISTRIBUTION OF *STERNOCERA NITIDICOLLIS* C. AND G. (*BUPRESTIDAE*).

Maxwell Lefroy says (*Indian Insect Life*, page 330): '. . . they (viz. *Sternocera nitidicollis*) are rarely found outside the hills and forest areas, being occasionally captured . . .' In this connection, it may interest your readers to know that I have often come across these beautiful beetles in many parts of North Gujarat which borders on the Rann of Cutch. These beetles are very partial to the Ber tree. Professors Asana and Sutaria have also obtained a fairly large number of these beetles from the Ber trees in the vicinity of the Gujarat College and adjoining fields. These beetles are very hardy animals and have laid eggs in the laboratory.

AHMEDABAD, H. G. ACHARYA, F.Z.S.
NORTH GUJARAT.
June 29, 1938.

[There are three specimens of *S. nitidicollis* C. and G. in the Society's collection, all from Southern India; Anarapura, Trimulgherry and Madras.

Perhaps the commonest species is *S. chrysis* F. It occurs almost throughout India. There are specimens in the Society's collection taken at places as far apart as Afghanistan, Nepal and Madras. McCann has found it to be not uncommon in the hills round Mt. Abu.—EDS.]

XXVI.—THE DISTRIBUTION OF *BUTHEOLUS MELANURUS* KESSLER.

On June 26, 1938, Dr. E. W. Hayward, Principal Medical Officer, Jodhpur, sent for identification a specimen of *Butheolus melanurus* Kessler. The known distribution of this scorpion within the limits of the Indian Empire is at present:

Northern Baluchistan (Maynard and MacMahon); Waziristan: Sewa (Caius); Punjab (Kraepelin); Rajputana: Jodhpur (Caius); Ahmedabad: Shevgaon (Caius).

ST. XAVIER'S COLLEGE, J. F. CAIUS.
BOMBAY.
July 6, 1938.

XXVII.—*GLYRICIDIA MACULATA* AS A SHADE TREE FOR TEA.

I have just been reading *Some Beautiful Indian Trees* by Blatter and Millard. I was very interested in the meaning of the word *Glyricidia*—rat-destroying. I shall be grateful if you would let me know if there is any further information available as to this alleged property of the seed of this tree. I should be particularly interested to know whether there is any information as to how this rat poison should be prepared. Do the seeds have to be cooked or ground and mixed with some other bait, or will rats eat them raw.

Glyricidia maculata was introduced here some eight or ten years ago and tried as a possible alternative to the Dadap, *Erythrina lithosperma,* as shade and green manure combined, for tea. The original seed sent to me came from Java. It has not proved to be a serious competitor of the dadap in usefulness as it is very much slower growing and, in our climate, most plants drop their leaves in the dry season from February to April just when the shade is most required for the tea. In addition it requires a great deal more attention and does not give anything like the same weight of loppings as the dadap. When planted from seed or cuttings the plant has an irritating habit of sending up multiple stems from the base each year as soon as the pre-monsoon rains arrive, and these have to be pulled off if a single stem tree and not a bush is required.

Apart from these drawbacks, the tree is hardy and easily struck from cuttings. Like the dadap it will strike from large branch cuttings of considerable length and size. It also stands up to continual lopping without any trouble.

The young trees here started to flower and seed some five years from planting both from seed and cuttings. The flowers generally appear in the dry weather towards the end of February and March about the same time as the trees begin to drop all their leaves.

This estate is some 3,600 ft. high and the average rainfall is about 120 inches per year. The South-West monsoon is very heavy giving about 30 inches a month for June, July and August. More or less light showery weather continues until the beginning of December. There is little if any rain in January, February and March and from the end of March until the monsoon breaks again there are heavy north east thunder-storms.

MONICA ESTATE,
VALPARAI P.O.,
S. INDIA.
May 27, 1938.

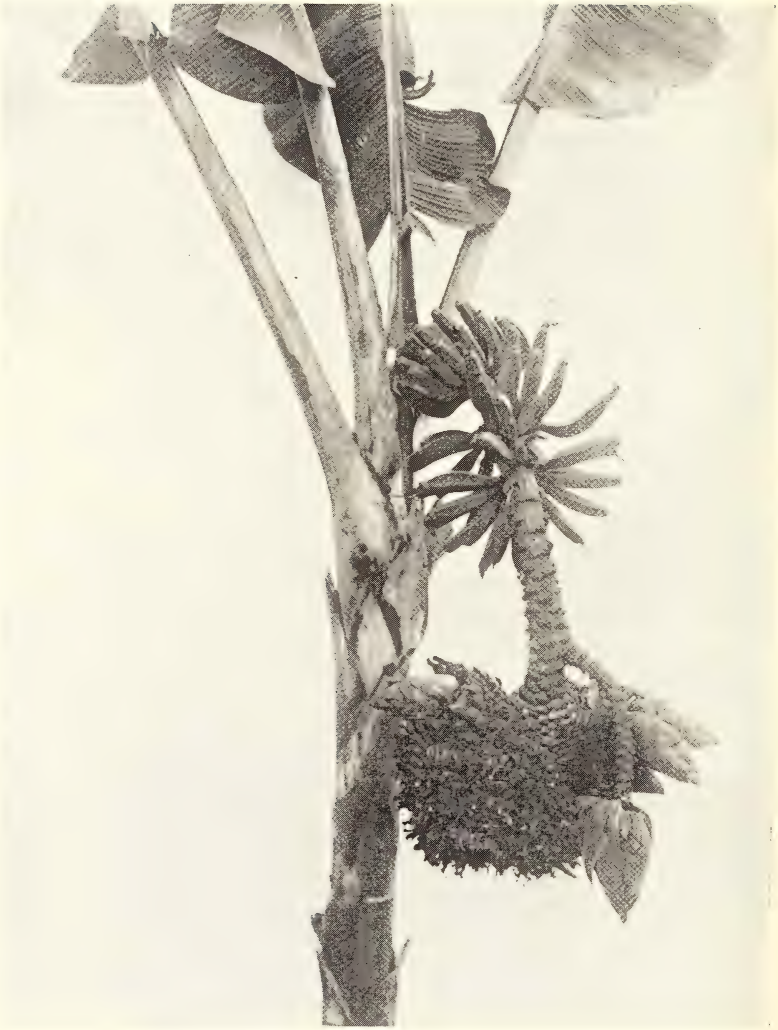
J. WILLIAMS.

[We have no information on the subject of the use of the seeds of this tree as a rat poison.—EDS.]

XXVIII.—GENERAL FLOWERING OF *STROBILANTHES* IN SOUTH INDIA.

As recorded in my note no. 25 published in the *Journal* of December 15, 1937 most of the species of *Strobilanthes* in this area flowered in 1936-37. The plants have died and disappeared so that a stranger visiting for the first time would conclude that very few Strobilanthes grew here.

Last month I found a single plant in flower in a swamp on the edge of a jungle belt on this estate. All the other Strobilanthes in this swamp had flowered and died last year. Specimens were sent to Mr. P. N. Mayuranathan, the Botanist of the Government



Fasciated inflorescence in a Banana.

Museum, Madras who has identified the species as *Strobilanthes lundus*.

MONICA ESTATE,
VALPARAI P.O.,
S. INDIA.
April 22, 1938.

J. WILLIAMS.

XXIX.—A FASCIATED INFLORESCENCE IN A BANANA.

(*With a photo*).

A very interesting phenomenon was noticed for the first time at Virarajendrapet, Coorg, in the banana variety Kali, locally known as 'Mara Bale' (*Musa paradisiaca*, Linn., var., *Kali*, K. C. Jacob[1]) the axis of which, after normal bunching, fasciated and produced a dozen different 'hearts' (cone-like inflorescence) of pistillate flowers developing into innumerable diminutive fruits while the original staminate 'heart' remained as such. The specimen is preserved in the Madras Herbarium, Coimbatore.

AGRICULTURAL RESEARCH INSTITUTE,
COIMBATORE.
April 7, 1938.

K. C. JACOB,
L.Ag., F.L.S.

XXX.—A NATURAL HISTORY TALE.

Scene: Honnametti Estate, Billigirirangans.

Planter's wife receives complaint from local Sub-Assistant Surgeon.

S.A.S.—'Madam, will you please report to Mr. M. that yesterday evening my wife was struck by a wild boar's tail while entering the ladies' retiring room near our Quarters'.

P.W. (surprised, bearing in mind the ridiculously small tail pig carry)—'Really, I should have thought that hardly possible'.

S.A.S. (slightly aggrieved)—'Madam, I can assure you that my wife *was* struck by the tail of a wild boar'.

P.W.—'Very well, I will inform Mr. M.; I saw a sounder of pig myself crossing the road near the dispensary a day or two ago'.

S.A.S.—*'Pig*, Madam?! My wife was struck by a *wild boa constrictor*'.

HONNAMETTI ESTATE,
ATTIKAN—MYSORE P.O.,
S. INDIA.
August 22, 1938.

R. C. MORRIS.

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[1] *The Madras Agricultural Journal*, vol. xxii, no. 2, p. 41.

PROCEEDINGS.

BOMBAY NATURAL HISTORY SOCIETY.

A meeting of members of the Bombay Natural History Society and their friends was held at the Prince of Wales' Museum on Thursday the 28th July, 1938 at 6-15 p.m. Rev. Fr. J. F. Caius, S.J. presided.

The Honorary Secretary announced the election of the following twenty-eight members since the last meeting held on the 24th March, 1938:—

Mr. R. E. Hawkins, Bombay; Mr. R. T. Ashby, R.A., Peshawar; Mr. Mark A. Wynter-Blyth, M.A., Simla; The Officer-in-Charge, Central Agricultural Library, Hyderabad, Deccan; Mr. S. F. Christie, Bombay; H. H. The Maharana of Danta State; Mr. Paul de Launey, Bengal; Mr. John Abel, Peshawar; Raja Bahadur Jawahir Singh of Sarangarh; Raja of Mahmudabad, Mahmudabad, U.P.; Mr. N. H. Menesse, I.S.E., Hyderabad, Sind; Mr. R. W. Aitken, Bombay; The Hon'ble Lt.-Col. Sir S. Hissam ud Din, Peshawar; Maharaja of Patna State; Mr. A. B. Barrett, Sylhet, Assam; Mr. Derek Headly, Palestine; Rev. J. W. Ruddell, Bombay; Mr. F. W. Goodwin, Simla; Conte Georgio U. della Gherardesca, Italy; Mr. E. C. Ormond, Calcutta; Mr. G. W. Gemmell, Calcutta; Mr. P. Burnside, B.F.S., Rangoon; Mr. S. T. Moses, Baroda; Mr. J. I. Alfrey, Bombay; Mr. R. W. V. Palmer, Rangoon; Mr. Oscar Lindgren, Kalimpong; Mr. K. H. Fraser, Tellicherry; Mrs. Mehra K. A. Lalkaka, Bombay.

SENSITIVITY IN PLANTS.

Dr. Bharucha, Professor of Botany, Royal Institue of Science, Bombay, in the course of his lecture pointed out that though plants seem immobile and inert and, therefore, unlike animals with their reflex movements and pulsating organs, yet a plant is as sensitive to its surroundings as an animal. By a series of slides the lecturer showed how the plant is stimulated or depressed on subjection to different stimulants or drugs. Even a passing cloud records its impressions on the plant. Just as an animal or man is fatigued with work so also does a plant show the effect of work by finally ceasing to function. Not only this, but it even betrays the expiring struggles that an animal shows before its death. In short, the lecturer showed, that a plant is as sensitive to light, temperature, humidity, drugs, chemicals and food as the animal is. As a matter of fact the various phenomena exhibited by plants are due to this characteristic of the plant, namely its high and animal-like sensitivity to changing environment. The opening and closing of flowers is a phenomenon brought about by the different degrees of sensitivity of flowers to light and temperature. Certain plants like the 'Four O'Clock plant' opens its flowers at four o'clock in the evening only, while others like the Water-lily open only about eight or nine in the morning. The movements of the leaves which droop down on a hot summer's day in the afternoon or which close down at night time, are again due to the same reason namely high temperature. Dr. Bharucha concluded by showing that the plant is just as apt to be stimulated or depressed as an animal and that it experiences pain and pleasure or fatigue and requires rest like any human being and that it is capable of all the nervous reactions felt by an animal.

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NOTICE

THE EDITORS MUCH REGRET THE DELAY IN THE PUBLICATION OF THIS NUMBER OF THE JOURNAL: THIS WAS UNAVOIDABLE OWING TO LABOUR TROUBLE AT THE PRESS.

CONTENTS OF VOLUME XL, No. 4.

PAGE

THE GAME FISHES OF INDIA, Part VI. By Dr. S. L. Hora, D.SC., F.R.S.E., F.Z.S., F.R.A.S.B., F.N.I. (*With one coloured plate and 2 text figures*) ... 583

THE TWO-HORNED ASIATIC RHINOCEROS (*Dicerorhinus sumatrensis*) By Theodore Hubback. (*With 8 plates*) ... 594

ADDITIONAL NOTES ON THE ASIATIC TWO-HORNED RHINOCEROS. By S. H. PRATER, C.M.Z.S ... 618

THE BIRDS OF BOMBAY AND SALSETTE, Part VI. By Salim Ali and Humayun Abdulali ... 628

NOTES ON THE DISEASES OF TROUT AT THE MAHILI HATCHERY—KULU (PUNJAB). By Dr. Hamid Khan, M.SC., LL.B., Ph.D. (*With a plate*) ... 653

NOTES ON BUTTERFLIES OF THE SHAN STATES, BURMA. By Capt. W.C. Carrott ... 657

BIRD PHOTOGRAPHY IN INDIA. By Major R. S. P Bates, M.B.O.U., (*With 6 plates*) ... 666

THE EARLY STAGES OF INDIAN LEPIDOPTERA. Part II. By D. G. Sevastopulo, F.R.E.S. ... 681

THE MEDICINAL AND POISONOUS CRUCIFERS OF INDIA. By Rev. J. F. Caius, S.J., F.L.S ... 693

BOMBAY'S FISHING INDUSTRY. By Dr. S. B. Setna, M SC., F.R M.S., Ph.D ... 713

THE HABITS OF THE COMMON EARWIG OF ANNAMALAINAGAR, *Euborellia stali* (Dohrn). By K. B. Thiagarajan, B.SC. ... 721

EARTH-EATING AND SALT-LICKING IN INDIA. By Rev. J. F. Caius, S.J., F.L.S., and Miss K. S. Radha, M.SC ... 724

REVIEWS :—

1. Pageant of Wings. By Douglas Gordon ... 727
2. Trees and Men. By E. Hughes-Gibb ... 727
3. Le petit peuple des ruisseaux. Par Marcel Piponnier ... 728
4. The Annual Report and Balance Sheet of the Ceylon Game and Fauna Protection Society for the Season 1937–38 ... 728

MISCELLANEOUS NOTES :—

I.—Why Elephants visit Salt-licks. By T. Hubback ... 730
II.—The Mating of Elephants. By J. Gonzalez ... 731
III.—Behaviour of Gaur or Indian Bison (*Bibos gaurus*). By F J. Mustill, I.F.S ... 731
IV.—Derivation of the name Seladang. By C. Gimson ... 733
V.—Sore Neck in Sambar. By W. S. Thom ... 733
VI.—The Record Thakin Head. By F. Wooley Smith. (*With a photo*) ... 736
VII.—A Tree Mouse (*Vandeluria oleracea*) in the nest of a Spider. By H. G. Acharya, F.Z.S ... 737
VIII.—Number of young of Long-tailed Tree-Mouse (*Vandeluria oleracea*). By H. G. Acharya, F.Z.S ... 739
IX.—Leopards from vicinity of Naga Hills. By G. H. L. Marshall ... 739
X.—Measurements of Tigers shot in the Naga Hills. (A correction). By G. H. L. Marshall ... 740

JUL 13 1939

PAGE

XI.—Migration and Methods of Bird Snaring in North East Arabia. By Mrs. H. R. P. Dickson. (*With 5 text figures*) 740

XII.—Birds observed in and near Tambaram, South India. By Mrs. A. M. Barnes.. 744

XIII.—The Distribution and Nidification of the Indian (Punjab) Raven (*Corvus corax laurencei* Hume) in Sind. By K. R. Eates, F.Z.S., M.B.O.U.. 747

XIV.—A Note on the Resident Owls of Sind. By K. R. Eates, F.Z.S., M.B.O.U.. 750

XV.—Vultures feeding at night. By T. R. Livesey.................. 755

XVI.—The Status and Nidification of the Persian Bee-eater (*Merops persicus persicus* Pall.) in Sind. By K. R. Eates, F.Z.S., M.B.O.U.. 756

XVII.—Haunt and Habitat of *Pitta c. cucullata* Hartl. in West Bengal. By S. C. Law. (*With a plate*)........................ 759

XVIII.—On the occurrence of the Indian Purple Moorhen (*Porphyrio p. poliocephalus*) in Chitral. By H. S. Stansfeld............ 762

XIX.—On the occurrence of the Banded Crake (*Rallus e. amuroptera*) and the Malabar Wood-pecker (*Macropicus j. hodgsoni*) in the Billigirirangan Hills, S. India By R. C. Morris, F.Z.S., F.R.G.S.. 763

XX.—The Breeding of the Indian Sooty Tern (*Sterna fuscata infuscata*) in the Laccadive Islands. By F. N. Betts........ 763

XXI.—Migration routes of Geese. By R. E. Parsons.................. 764

XXII.—Cotton Teal (*Nettopus coromandelianus*) at Nasik. By C. J. Rae.. 765

XXIII.—'Fish of Great age'. By Peter Michael........................ 765

XXIV.—On the nesting Habits of the Gourami (*Osphronemus gorämy* Lacépède). By S. Jones.................................. 766

XXV.—Fresh Water Fishes of North Gujrat. By H. G Acharya, F.Z.S.. 772

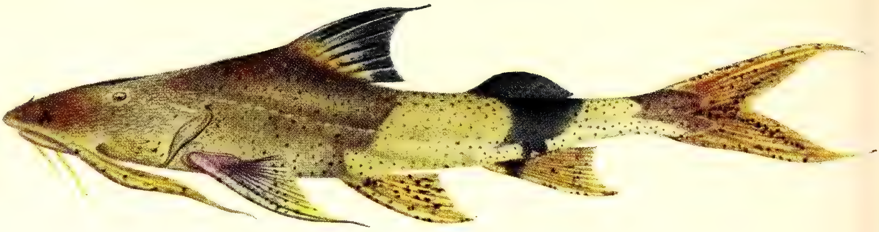
XXVI.—A case of poisoning from the bite of a spider. By R. E. Parsons.. 773

XXVII.—On the occurrence of certain Butterflies at Nasik. By C. J. Rae.. 775

XXVIII.—An improved Cellophane wing mount. By D. G. Sevastopulo, F.R.E.S.. 775

XXIX.—The Original Home of the Coconut. (*A correction*). By P. V. Mayuranathan.. 776

XXX.—Occurrence of two plants new to Kashmir. By P. N Kohli.. 777



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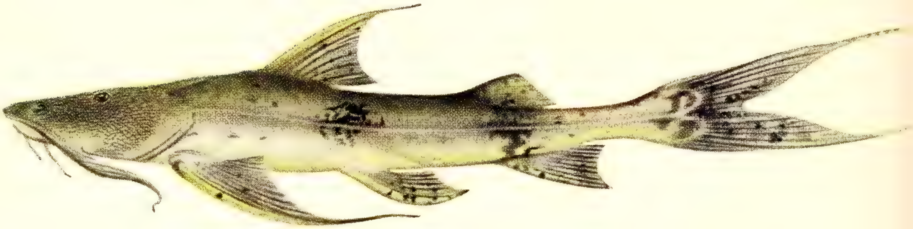

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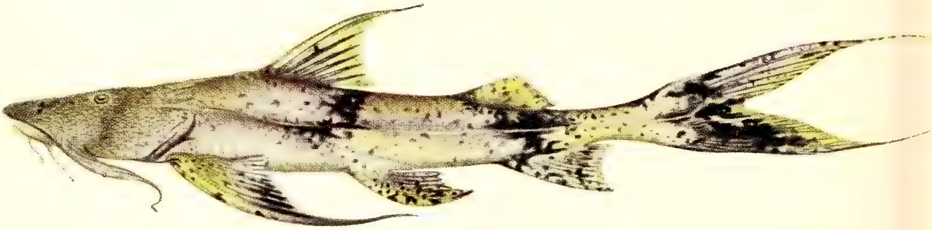

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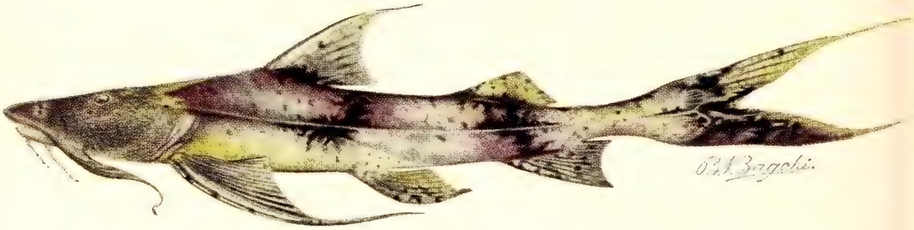


4.

THE GOONCH

Bagarius bagarius (Hamilton).

JOURNAL
OF THE
Bombay Natural History Society.

1939. Vol. XL. No. 4.

THE GAME FISHES OF INDIA[1]

BY

Sunder Lal Hora, D.SC., F.R.S.E., F.Z.S., F.R.A.S.B., F.N.I.,

Assistant Superintendent, Zoological Survey of India, Calcutta.

(*With one plate and two text-figures*).

Continued from page 366 of Vol. xl.

VI.—The Goonch.

Bagarius bagarius (Hamilton).

Contents.

	PAGE
Introduction	583
Nomenclature and Systematic Position	584
Synonymy and Description	585
Bionomics and Fishing Notes	590
Acknowledgments	592
List of References	592
Explanation of Plate	593

Introduction.

The *Goonch* is well known, as an undesirable species, to anglers who fish for *Mahseer* in the large rivers of India. It lives in *Mahseer* waters, and must be cleared out of such areas as it is otherwise likely to break the tackle. The *Goonch* is one of the largest freshwater fish that has hitherto been caught in this country on rod and line. The smaller specimens generally give fairly good sport, but the monsters of the Ganges apparently give but little play. The name 'freshwater shark' is more aptly applied to the *Goonch*, not only on account of its great voracity but also owing to its underhung mouth and general ugliness; it grows to a size of six feet or more and to a weight of over 250 lbs.

---

[1] Published with permission of the Director, Zoological Survey of India.

JUL 13 1939

The *Goonch, Bagarius bagarius* (Hamilton), is remarkable among the present-day Catfishes for its morphological features and great antiquity. Though several other genera are usually grouped with it in the family Bagaridae or Sisoridae, none approaches it in size. Most of them are of small size and live in clear waters of hill-streams adhering to rocks and stones. *Bagarius* is, however, known to descend to the lower reaches of the larger rivers as well. Fossil remains of the *Goonch* are known from the Tertiary deposits of the highlands of Padang in Sumatra and the Siwalik rocks of India. These records are not only helpful in indicating the first appearance of Catfishes (Siluroidea) but also show that the *Goonch* was as widely distributed in south-eastern Asia about five million years ago as it is at the present day. Further, it is remarkable that the *Goonch* has persisted throughout this long period without any appreciable change in its general appearance, and may thus be regarded as a 'Living Fossil'.

NOMENCLATURE AND SYSTEMATIC POSITION.

Like the freshwater sharks dealt with in the two preceding articles of this series, the *Goonch* was also described for the first time by Hamilton (**7**)[1] in his composite genus *Pimelodus* and characterised as

> 'A *Pimelodus* with the tail fin divided into two very long-pointed unequal lobes; with eight tendrils not longer than the head; with a scabrous opaque body, variegated with black irregular marks; with thirteen rays in the fin behind the vent; and with eight in the foremost fin of the back.'

Swainson (**11**) included it in his genus *Pachypterus* along with a number of divergent forms and re-christened it *P. luridus*. Cuvier and Valenciennes (**5**), and in his earlier works Bleeker (**2, 3**) also, subscribed to Hamilton's views regarding the systematic position of the *Goonch*, but in 1853 Bleeker (**4**) proposed the generic name *Bagarius* for its reception and termed it '*Bagarius Buchanani*'. But as Sykes (**12**) had already described the *Goonch* from Poona under the specific denomination '*Bagrus Yarrelli*', the fish came to be known in scientific literature as *Bagarius yarrellii*. However, in accordance with the provisions of the International Rules of Zoological Nomenclature it is not permissible to change the specific name of the species except under very special circumstances. The correct scientific designation of the species should, therefore, be *Bagarius bagarius* (Hamilton), and it is under this title that the fish is generally referred to in modern literature.

Though Popta (**9**) described another species of *Bagarius—B. nieuwenhuisii*—from Central Borneo, Weber and de Beaufort (**14**) have shown it to be merely a colour variety of the *Goonch*. From the colour plate reproduced here and text-fig. 1 it will be seen that the fish is very variable both as regards its colour and form. In view of the above the genus *Bagarius* is monotypic so far.

---

[1] Numerals in thick type within brackets refer to the serial number of the various publications listed in the bibliography at the end of the paper.

As indicated above the *Goonch* is included along with several other hill-stream genera in the family Bagaridae or Sisoridae. In these fishes the dorsal fin is short, with a pungent spine and 6 or 7 divided rays, and is situated considerably in advance of the ventral fins. The adipose fin is present and is placed opposite to the anal fin. The paired fins are horizontal; the pectorals are provided with a serrated spine and the ventrals contain only 6 rays. The body is usually flattened dorso-ventrally and the eyes are subcutaneous. The two nostrils on each side are situated close together, being separated by a membranous fold produced into a short nasal barbel. The mouth is usually overhung by the snout and is either transverse or crescentic. The jaws are provided with small teeth in bands; these are sometimes mixed up with larger teeth. The palate is edentulous. There are eight barbels; one pair nasal, one pair maxillary and two pairs mandibular. The maxillary barbles possess broad and stiff bases. According to Regan (**10**), the genus *Bagarius* is distinguished from the other members of the family by a combination of the following characters:—

> 'Anterior precaudal vertebrae with a series of processes on each side directed upwards and outwards from the bases of the neural arches; head depressed.
>
> 'Lips normal; mesopterygoid large, extending forward below the palatine and backwards to the hyomandibular; complex centrum rigidly united, but not ankylosed to cranium; parapophysis of fourth vertebra a half-cylinder, of fifth a stout horizontal process ending just beneath the skin.
>
> 'Ribs inserted on normal transverse processes; pelvics behind the dorsal; gill-membranes free or narrowly attached to isthmus.
>
> 'Thorax without longitudinal plaits.'

The other two allied genera of the family are *Glytothorax* Blyth and *Pseudecheneis* Blyth; the former possesses longitudinal and the latter transverse adhesive plaits in the thoracic region. In its general appearance the *Goonch* is so characteristic that it is impossible to mistake it for any other fish.

The fishes of the family Bagaridae were probably evolved from some generalised members of the large group of Bagrid fishes, from which they differ in certain features of specialisation likely to have been induced by life in rapid-running waters.

SYNONYMY AND DESCRIPTION.

Bagarius bagarius (Hamilton).

1822. *Pimelodus bagarius*, Hamilton, *Fish. Ganges*, pp. 186, 378, pl. vii, fig. 62.

1839. *Pachypterus luridus*, Swainson, *Nat. Hist. Fish.*, etc., ii, p. 306.

1840. *Pimelodus bagarius*, Cuvier and Valenciennes, *Hist. Nat. Poiss.*, p. 146, pl. ccccxxxiii.

1841. *Bagrus Yarrelli*, Sykes, *Trans. Zool. Soc. London*, ii, p. 370.

1847. *Pimelodus bagarius*, Bleeker, *Verh. Bat. Gen.*, xxi, I, p. 10.

1849. *Pimelodus yarrellii*, Jerdon, *Madras Journ. Litt. and Sci.*, xv, p. 141.

1850. *Pimelodus bagarius*, Bleeker, *Verh. Bat. Gen.*, xxiii, p. 10.

1853. *Bagarius Buchanani*, Bleeker, *Verh. Bat. Gen.*, xxv, p. 121.

1858. *Bagarius Buchanani*, Bleeker, *Ichth. Arch. Ind. Prodr.*, I Siluri, p. 212.

1862. *Bagarius Buchanani*, Bleeker, *Atl. Ichth.*, ii, p. 61.

1864. *Bagarius yarrellii*, Günther, *Cat. Fish. Brit. Mus.*, v, p. 183.

1877. *Bagarius yarrellii*, Day, *Fish. India*, p. 495, pl. cxv, fig. 3.

1877. *Bagarius yarrellii*, Beavan, *Freshw. Fish. Ind.*, p. 145.

1889. *Bagarius yarrellii*, Day, *Faun. Brit. Ind., Fish.*, i, p. 194, fig. 71.

1890. *Bagarius Yarrellii*, Vinciguerra, *Ann. Mus. Civ. Stor. Nat. Genova*, (2), ix, p. 243.

1904. *Bagarius Nieuwenhuisii*, Popta, *Notes Leyden Mus.*, xxiv, p. 190.

1906. *Bagarius Nieuwenhuisii*, Popta, *Notes Leyden Mus.*, xxvii, p. 66.

1912. *Bagarius bagarius*, Weber and de Beaufort, in Maass 'Durch Zentral-Sumatra', ii, Fische, p. 16.

1913. *Bagarius bagarius*, Weber and de Beaufort, *Fish. Indo-Austral. Archipel.*, ii, p. 270, fig. 105.

1929. *Bagarius bagarius*, Prashad and Mukerji, *Rec. Ind. Mus.*, xxxi, p. 181.

1933. *Bagarius yarrellii*, Spence and Prater, *Journ. Bombay Nat. Hist. Soc.*, xxxvi, p. 59, pl. xv.

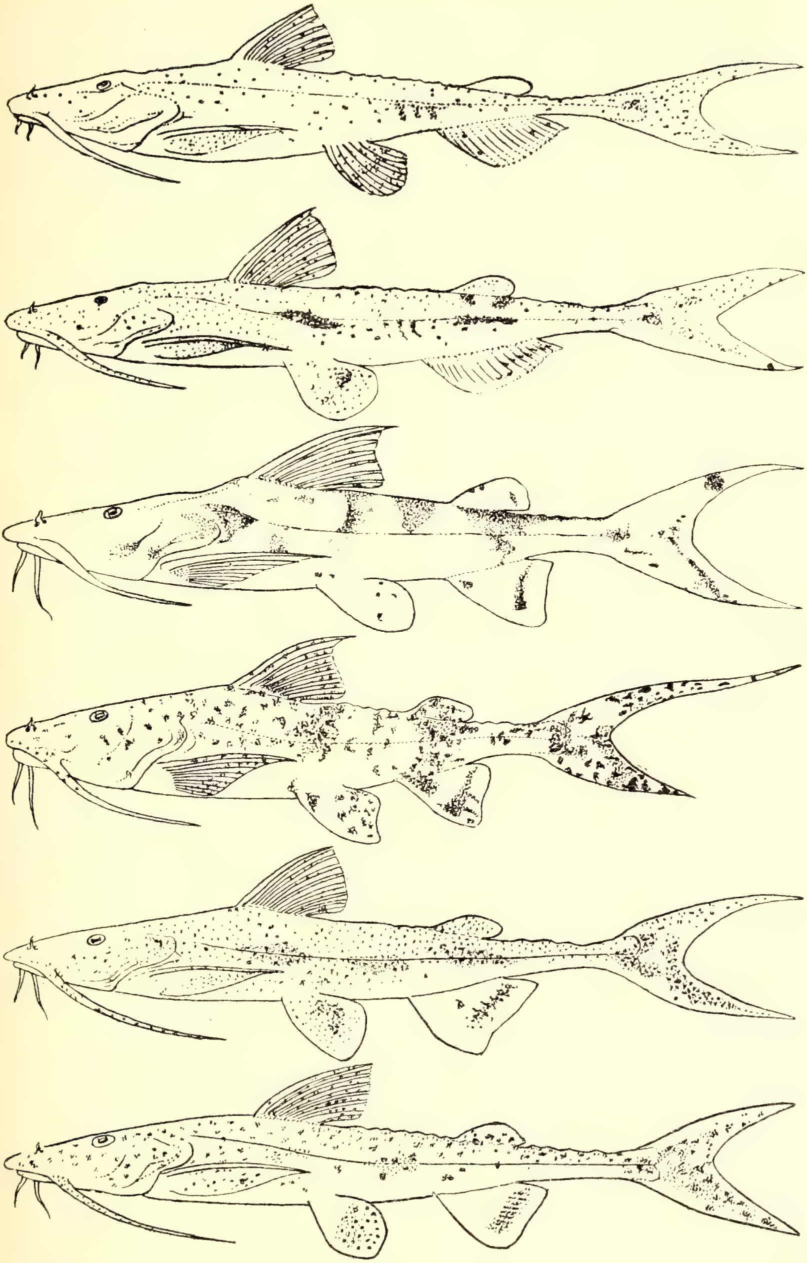
1937. *Bagarius bagarius*, Fowler, *Proc. Acad. Nat. Sci. Philadelphia*, lxxxix, p. 144, fig. 38-43.

Vernacular names:—*Bágh Ari* (Dinajpur and Rungpur); *Vágháir* (Purniah); *Boonch* or *Goonch* (N. W. Provinces); *Goreah* or *Bagh Machh* (Assam); *Rahti jellah* (Telugu); *Sah-lun* (Ooriah); *Kheerd, Moolandah* and *Guwch* (Poona and environs).

B 12; D. 1/6 | 0; A. 12-15; P. 13; V. 6; C. 17.

In *Bagarius bagarius* the head, the upper surface of which is naked, osseous and rugose in regular bands and lines, is greatly depressed. In consequence, the head and the anterior part of the body are flattened on the ventral surface. The skin on the body is also somewhat scabrous. The length of the head is contained from 2.9 to 3.3 times in the standard length; in medium sized specimens the height of head is contained from 1.6 to 2.0 times and its width from 1.2 to 1.3 times in the length of the head; but in a young specimen from Orissa the proportions are quite different as the head is relatively less broad but at the same time considerably depressed. In this young specimen the body is also greatly depressed, its height being contained 7.9 times in the standard length. Usually the height of the body is contained from 4.8 to 6.0 times in the length of the body. The width of the body is either equal to or greater than its height. The caudal peduncle is narrow and whip-like; its least height is contained from 3.1 to 3.8 times in its length. The eyes are small, dorsally placed and situated in the posterior half of the head. The mouth is situated on the ventral surface considerably behind the tip of the snout; the extent of its gape is equal to 4/7 of the length of the head. The teeth are sharp and of unequal size in the jaws. There is an outer widely separated row of larger ones in the mandibles. There are eight barbels; the nasal barbels are generally smaller than the diameter of the eye; the maxillary barbels possess broad bases and are generally shorter than the head; the two mandibular pairs are also very short.

The dorsal fin is considerably in advance of the ventrals; its spine is smooth, with an elongated soft termination of varying length; the osseous portion of the spine is almost as long as the head without the snout. The pectoral spine is stronger, as long as or slightly longer than the dorsal, serrated internally and provided with a soft prolongation. The caudal fin is deeply forked, the upper lobe is longer and both the lobes are produced into soft filamentous processes.



Text-fig. 1.—*Bagarius bagarius* (Hamilton), showing variation in form and colouration. (After Fowler, **6**.)

The air-bladder is small and is divided into two lateral chambers, which are situated one on each side in a deep groove formed in the consolidated transverse processes of the compound vertebra, The *Goonch* is variable as regards its form and colouration, and as it grows to a very large size the body proportions are found to vary considerably with the size of the fish. The colouration of the species will also depend on the type of water inhabited by a particular specimen. Hamilton (**7**) noted that 'The *colour* is greenish ash, very pale below; and not only on the body, but on the fins, are scattered large irregularly shaped black marks. The eyes are golden-coloured'. In the case of specimens from Poona Sykes (**12**) found the 'Colour of the fish deep olive-brown, towards the belly yellowish brown, and marked with spots like a Dalmatian dog.' A nearly uniformly coloured variety of *Bagarius bagarius* was described by Popta (**9**) as *B. nieuwenhuisii.*

In the colour plate accompanying this paper, figure 1 represents the colouration of a Burmese specimen obtained by Mr. J. A. Burnes from the Nam Lon Stream, near Takaw, in the Southern Shan States on the 21st of July, 1934. Mr. Burnes sent a colour sketch of the specimen along with a description of its colouration. His description of the colouration is as follows:—

> 'Multicoloured fish, yellow black, brown and blue.
>
> 'Two blue streaks on head between eyes. One blue streak on back in front of anterior dorsal fin. Anterior dorsal fin: orange below and bluish with black spots above. Posterior dorsal fin: blue with black spots. Pectoral fins: reddish at roots with black spots throughout, tips yellow. Ventral fins: orange ground with black spots. Caudal and anal fins: same as ventrals. Anterior half of body: brown ground with black and yellow spots. Middle part of body: yellow ground with black spots. Part of body about the posterior dorsal fin: grey ground with black spots. Part of body behind the posterior dorsal fin: yellow ground with black spots.'

The outline of other figures on the colour plate are of a specimen from North Assam, but the colouration in the three figures represents variations exhibited by specimens taken near Calcutta. Figure 2 shows the colouration of a specimen obtained from the Settling Tanks of the Calcutta Corporation Water-works at Pulta. When just taken out of water the head was greenish grey while the dorsal surface was of a dark-greyish olive-green colour. The rayed dorsal was brownish pink anteriorly and light grey with black spots posteriorly. Behind the first dorsal and below the second dorsal there were two irregular, vertical black markings. The caudal peduncle was pink above and slightly yellow with pale grey below. The caudal was light yellowish grey. The anterior rays of the paired fins were yellowish while their remaining portions were light grey with black spots. The anal fin was light green anteriorly and light grey, with black spots, posteriorly. The ventral surface was light yellow with pale grey. An hour or so after its removal from water the colour changed to what is represented in figure 3. Figure 4 represents the colouration of a dead specimen caught in one of the canals in the neighbourhood of Calcutta and presented to the Zoological Survey of India.

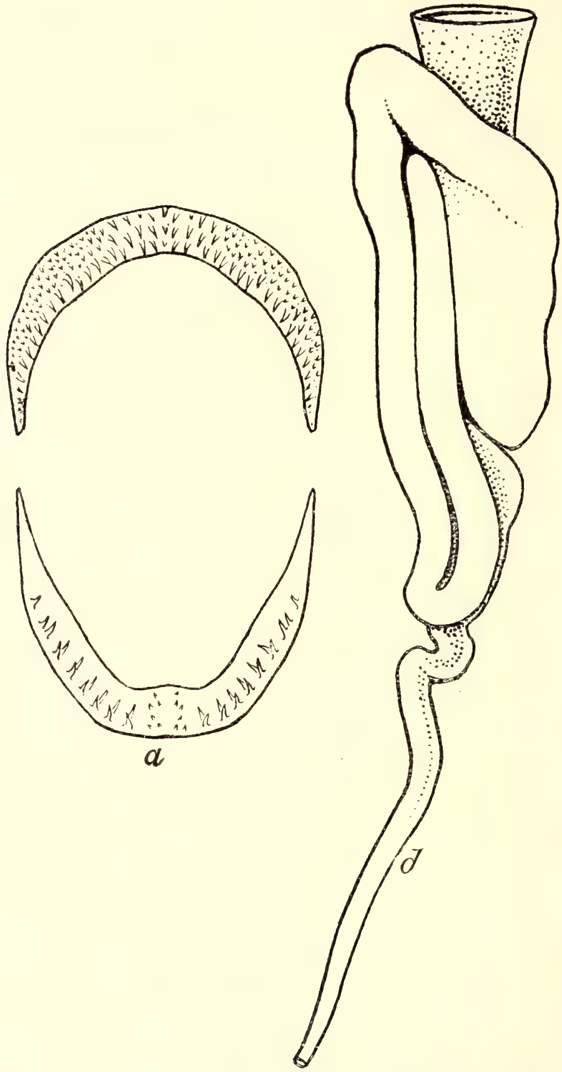
Distribution:—*Bagarius bagarius* is known from all over India, Burma, Siam, Malay Archipelago and Tonkin.

Measurements in millimetres.

	Orissa	Poona	Assam		Burma		
			Cachar	Mergh-erita	Myitkyina Dist.	S. Shan States	
Standard length	67·5	292·5	260·5	313·0	207·0	230·0	277·0
Length of head	23·0	90·0	81·5	98·5	65·1	72·0	84·0
Width of head	14·0	65·5	64·0	73·5	48·1	53·0	70·5
Height of head	9·0	54·5	43·5	49·5	33·0	37·5	49·5
Diameter of eye	3·0	8·0	8·0	8·0	6·5	6·5	7·5
Length of snout	10·0	43·0	39·5	48·0	32·0	37·0	44·0
Interorbital distance	6·0	28·5	24·5	28·5	18·0	19·5	23·5
Height of body	8·5	60·0	48·0	52·0	35·0	40·5	49·0
Width of body	8·5	56·5	50·5	52·0	37·0	40·5	55·0
Length of pectoral spine	12·0	44·0	46·0	55·0	Damaged	47·5	47·0
Length of dorsal spine	11·0	42·5	43·0	53·0	Damaged	47·0	Damaged
Length of nasal barbel	Not visible	6·0	3·0	6·0	2·0	1·5	3·0
Length of maxillary barbel	22·0	78·0	54·0	75·0	48·5	70·0	78·0
Length of outer mandibular barbel	6·0	27·0	17·5	29·5	20·0	24·0	25·0
Length of inner mandibular barbel	5·0	18·0	13·3	19·0	12·5	16·0	18·0
Length of caudal peduncle	13·5	47·0	41·0	47·0	34·0	46·0	52·0
Least height of caudal peduncle	3·5	13·0	13·1	14·0	9·5	12·5	14·0

Bionomics and Fishing Notes.

Reference has been made in the introduction to the voracity of the *Goonch.* Its formidable teeth (text-fig. 2*a*), bag-like, thick-walled stomach and only slightly convoluted alimentary canal (text-fig. 2*b*) fully testify to this habit.



Text-fig. 2.—Teeth and alimentary canal of a specimen of *Bagarius bagarius* (Hamilton) about 348 mm. in standard length. Nat. size.

A writer in the *Asian* of 27th February, 1883, thus described the general habits of *Bagarius bagarius*:—

> 'I generally find the Goonch occupying the very head of a rapid; they lie motionless with apparently no effort in the white water among the boulders

> at the foot of a smooth incline down which the water rushes with immense force through the open sluices of the weir. Some idea may be formed of the strength of the stream from the fact that the river Jumna, which is at this point about three-quarters of a mile wide, is artificially narrowed by a bund to a width of about thirty yards, this being the length of the weir through which nearly the whole volume of water has to pass when the sluices heading the Agra Canal just above the weir are closed. The monster weighing 136 lbs. caught by Mr. Van Cortland was, I believe, caught in the white water of the rapid, or just below it in the full strength of the stream, and I have frequently seen a Goonch take my spoon or minnow here as soon as it touched the water.
>
> 'They lie very often with their backs just out of water and are easily shot with a bullet.'

'Doon' in the *Asian* of 28th October, 1879, describes the spearing of the *Goonch* in the Ganges between Bijnore and Meerut. It is stated that

> 'When the bridge is "up", in the cold weather under the oldest boats, the "gonch" may be seen clinging on by feelers to the bottom. It struck me they could be speared, so a friend and myself sent down our canoes, armed ourselves with barbed spears, made so that the heads should *slip off* the handles, and drove down to the Ghat. The spear heads had about 20 yards of stout cotton string attached, and to the end of the rope an inflated (bullock's) bladder. When we saw the gonch, the spear was sent "home", and the shaft withdrawn. The fish at once went off, and the bladder keeping on the surface showed his course. We followed in canoes, and taking extra spears, gained the bladder and pulled up our prey, finishing him as best as we could. One morning my friend and myself killed three gonch thus, all but 80 lbs. If this sport can be got at one bridge, I see no reason why not at every one on the Ganges and Jumna, and other streams too, for gonch abounds down country, but I must say I have never tried it anywhere else but at that one bridge.'

In the cold season the *Goonch* probably hibernates as there are few records of the fish being caught at this time of the year. It takes spoon and spinning bait, and also live bait when big. On being hooked, it generally sulks, but the young provide fairly good sport.

For anglers a good account of the species is given by Thomas (**13**) in his *Rod in India* from which a few extracts are given below.

Once Mr. Cyril Kirkpatrick and Mr. Aldwell wanted to clear the *Goonch* out and for this purpose 'they used the strongest tackle, a male bamboo or ringol, on which they played them till they sulked, and then they simply hauled them out, hand over hand, on a cord as thick as a pencil.'

> 'Mr. Cyril Kirkpatrick also prefers the shallow at the head of the white water for these fish, where, letting the bait down the white water, the Goonch takes it for some exhausted fish that has failed to get past the shutters and is falling back. He also has a preference for a good stout cord that you can haul on to, so as not to waste time or try tackle over their sulking.'

The tackle recommended is the same as dressed for *Mahseer* on wire gimp No. 2/0. When it is intended to haul them out hand over hand a stronger gimp should be used.

Beavan (**1**) quotes from an article in the *Pioneer* to the effect that the best bait for the *Goonch* is the Spiny Eel or 'Bahm' (*Mastacembelus armatus*). 'Like most Siluroids this fish will only bite from dark till about two hours after dark, when if taken his maw will invariably be found empty; and then again from dawn till 8 o'clock. It seems to feed on the young of a species of herring,' (probably *Clupea chapra*).

In 1920, while collecting the fauna of the Manipur Valley in Assam, I was informed of a fish locally known as *Nga-len*, but I could not obtain any specimen during the period of my visit in February-March. The local name implies that the fish rarely moves but mainly lies at the bottom. The following remarkable account of the method of its capture was given to me (8).

> 'The Mohammedan fishermen who alone capture and eat this fish dive and search for it under water. On discovering a fish, they come out and take a rope with them and dive again to the same place. They tie the rope round the tail of the fish being always careful not to touch its belly as this immediately disturbs it. The rope is now taken on shore and two or three people drag the fish out. It is said to be the most powerful fish in the valley.'

At the time I was unable to identify the fish from the above account but from Thomas's description of the habits of the *Goonch* I am inclined to believe that the *Nga-len* of the Manipur Valley is *B. bagarius*.

ACKNOWLEDGMENTS.

As in the case of the previous articles in this series I have to express my sincere thanks to the authorities of the Bombay Natural History Society for making a grant towards the cost of the illustrations. Mr. K. S. Misra helped me with the preparation of the table of measurements, and for this I am indebted to him. The illustrations were prepared by Babu B. Bagchi with his usual skill and care under my supervision.

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EXPLANATION OF PLATE.

Colour sketches of *Bagarius bagarius* (Hamilton), showing variation in colouration in different localities and after the removal of specimens from water.

Fig. 1.—Colour sketch of a fresh specimen from Southern Shan States, Burma.

Fig. 2.—Colour sketch of a fresh specimen from Calcutta Corporation Waterworks at Pulta, near Calcutta.

Fig. 3.—Same as above, but after the specimen had been out of water for an hour or so.

Fig. 4.—Colour sketch of a dead specimen brought to the Indian Museum and stated to have been collected in a canal near Calcutta.

The outlines of the figs. 2—4 are of a specimen from North Assam.

THE TWO-HORNED ASIATIC RHINOCEROS.

(*DICERORHINUS SUMATRENSIS*).

BY

THEODORE HUBBACK.

(*With 8 plates*).

The Sumatran or Two-horned Rhinoceros (*Dicerorhinus sumatrensis*), of Asia, now regarded as a distinct genus, *Dicerorhinus,* the generic title *Rhinoceros* being reserved for the Indian and Java species, was once widely distributed, but owing to continual persecution for the sake of its horn and other parts of its anatomy it has been brought to the verge of extinction.

It is on observations made on this mammal in British Malaya that this monograph is based, but *sumatrensis* has been recorded from India, Burma, Indo-China, Siam, Sumatra and Borneo. Except in Sumatra, where its incidence has not been completely investigated, it appears that in these countries this species of rhinoceros is rapidly disappearing.

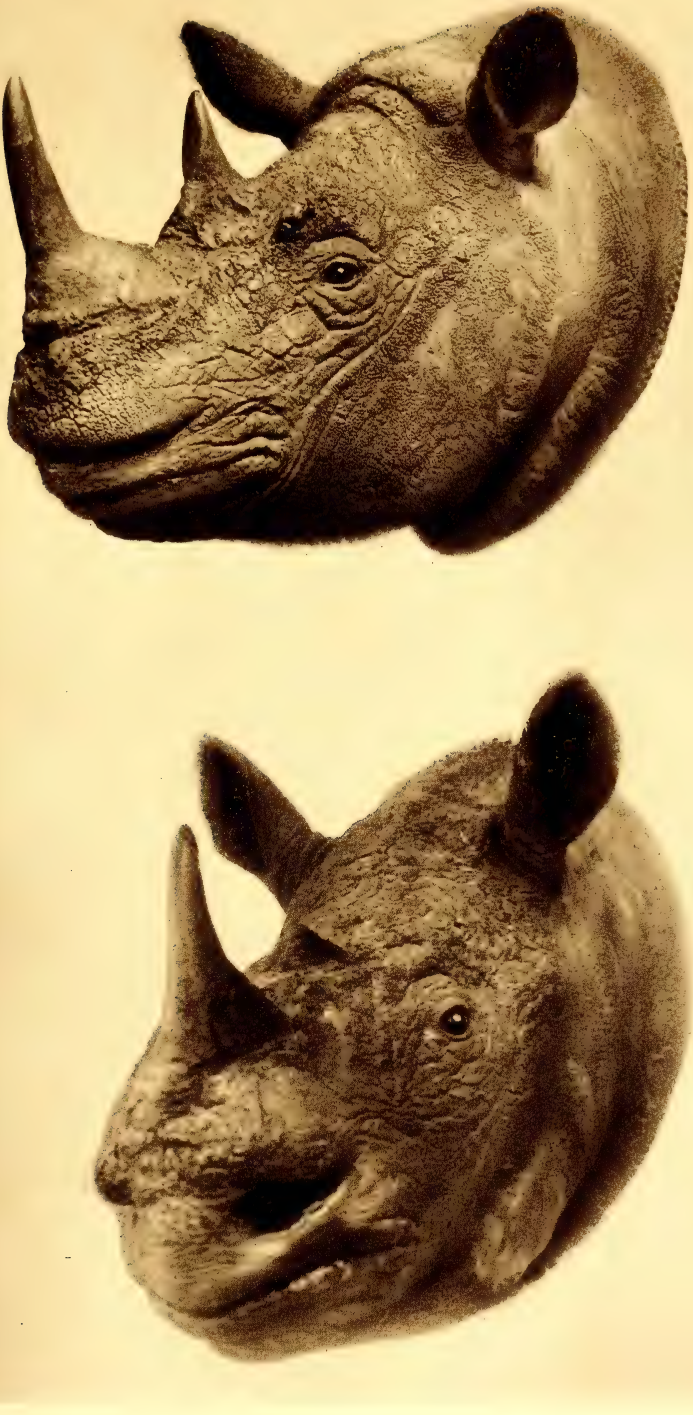
No doubt the habits of the Sumatran rhinoceros with local adaptations to different environments, would be much the same in all the above countries; still my ecological remarks must not be taken as applying to other countries than Malaya.

HISTORICAL.

The Asiatic two-horned rhinoceros was, according to Blanford, in his 'Mammalia' in the *Fauna of British India,* first named *Rhinoceros sumatrensis* by Cuvier in 1817. (See *Cuv. Règne An.* 1, page 240, 1817.) I have been unable to ascertain when the first record was made establishing the fact that there was a two-horned rhinoceros in Asia.

Greek writers described certain animals bearing a single horn and designated one as the Indian Ass. The first Greek writer to mention the rhinoceros was Strabo who wrote just before and after the beginning of the Christian era.

Rhinoceroses were seen in Europe for the first time in 61 B.C. when Pompey the Great introduced them to the games of the Roman circus. Pliny (23-79 A.D.), the Latin writer, mentions the rhinoceros and describes its fights with elephants. But these were probably African animals because those represented on the coins and sculpture of the Romans are shown with two horns and there is nothing to justify us in believing that these may have represented the *sumatrensis.* Marco Polo (1298) appears to have seen rhinoceroses in Java, probably *Rhinoceros sondaicus,* and presently I shall quote what he said about the rhinoceros which provides us with a link between the unicorn and the rhinoceros.



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Mounted heads of the Asiatic two-horned Rhinoceros—*Dicerorhinus sumatrensis (Cuv.)*—Pahang, Federated Malay States.
Above, old male: *Below*, old female.

It is well established that rhinoceroses have been known for centuries. The incidents of the unicorn as the animal of fable and the rhinoceros as the animal of fact may have some bearing on the superstitions attached to the rhinoceros. At least one legend associated with the unicorn has been passed on to the rhinoceros. The horn of the unicorn when made into and used as a drinking cup, was supposed to be able to detect poison and we find that even at the present time the same wonderful properties are assigned to the horn of the rhinoceros.

The idea of an animal's horn when used as a drinking cup detecting poison in any liquid placed in the cup is as old as Ctesias, who attributed this virtue to the horn of the Indian Ass, which, I think, must have been some species of Asiatic rhinoceros.

In a note in the 1840 Edition, published by Blackie & Son, Glasgow, of Oliver Goldsmith's *History of the Earth and Animated Nature*, which book, without the notes, was first published in 1774, we find the following in relation to rhinoceroses' horns.

> 'Thurnberg says, "It is generally believed that goblets made of the horns in a turner's lathe, will discover any poisonous draught that is put into them by making the liquor ferment until it runs quite out of the goblet. Such goblets are frequently set in gold and silver, and are regarded as suitable presents to kings, persons of distinction, or particular friends; or else they are sold at a high price, sometimes at the rate of fifty rix-dollars a goblet. When I tried these horns, both wrought and unwrought,—both old and young horns,—with several sorts of poison,—weak as well as strong,—I observed not the least motion or effervescence; and when a solution of corrosive sublimate, or other similar substance, was poured into one of these horns, there arose only a few bubbles, produced by the air which had been enclosed in the pores of the horn, and which was now disengaged from it." '
>
> 'Besides the use of its horns for goblets and handles of swords and daggers, there is scarcely any part of the animal which is not employed medicinally in the countries it inhabits.'

Another legend which long persisted in relation to the unicorn and was apparently also passed on to the rhinoceros was that this normally fierce animal was wonderfully gentle in the mating season, and from that evolved the idea that it became docile in the presence of a maiden and was lulled to sleep with its head on her breast. This fancy appears in the *Physiologus* which states:—'They send to it a pure virgin all robed. And the unicorn springs into the lap of the maiden and she subdues him and he follows her.'

But Marco Polo would have none of this in relation to the rhinoceros and when describing that animal wrote:—'It is a hideous beast to look at and in no way like what we think and say in our countries, namely a beast that lets itself be taken in the lap of a virgin. Indeed I assure you that it is quite the opposite of what we say it is.'

These superstitions attached to the mythical unicorn and bestowed on the substantial rhinoceros have been responsible for conferring on the rhinoceroses' horns and other parts magical properties resulting in its continual persecution which has brought all species of the Asiatic rhinoceros to the verge of extinction. The two-horned variety has in no way escaped the baleful influences of these illusions.

To come down to more modern times Prince Henri d'Orléans in his book *From Tonkin to India,* being an account of a journey made by him in 1895, records seeing the head of a two-horned rhinoceros in a druggist's shop at Mong-le, a small Chinese town in Yunnan, close to the Tonkin border, in, approximately, latitude 22.30N., and longitude 102E. The rhinoceros was alleged to have been killed about four miles away.

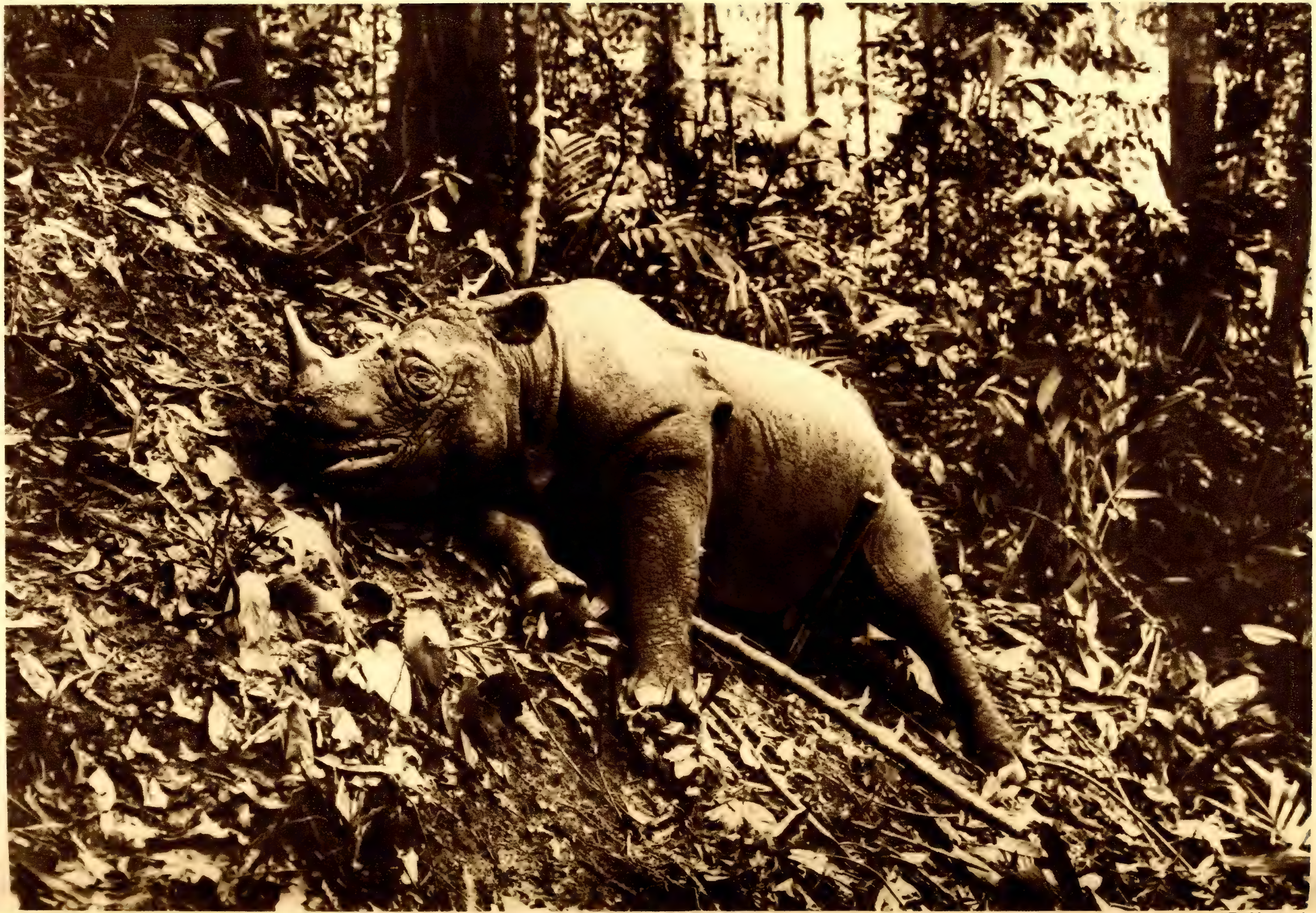
Again in the same book Prince Henri records that they found plenty of the spoor of rhinoceroses in the valley of the Nam-Tsai, near Assam. The rhinoceroses' trails must have been numerous because Prince Henri writes, 'We had to thank the latter (rhinoceros) for many an enlarged path and flattened bank.' He also stated that their guide Poulanghing explained that these were the tracks of the two-horned rhinoceros and that their flesh was good. This was in the Singpo country, approximately latitude 27.30N., and longitude 97E.

In view of what R. Lydekker wrote in his book *The Game Animals of India, Burma, Malaya and Tibet*, 1907 edition, regarding an unidentified species of two-horned rhinoceros which he suggested might be found in the Singpo country, this record is interesting. These two notes by so accurate an observer as Prince Henri show that the two-horned rhinoceros extended over a large area of country directly south of the Chinese and Tibetan borders, and as we know it is still to be found in Sumatra and Borneo no doubt in days gone by its distribution was very wide.

Henri Mouhot, the distinguished French Naturalist, in his book *Travels in Indo-China,* published in 1864, refers in Volume II to a rhinoceros hunt at which he was present in the Laos country, somewhere east of Luang Prabang, approximately in latitude 21N. and longitude 103E. There is an illustration accompanying this account which was drawn by M. Janet Lange from a sketch by M. Mouhot, but the animal depicted is obviously a *Rhinoceros sondaicus* and not a *Dicerorhinus sumatrensis*, the single horn and the fold across the back of the neck being clearly depicted. This is not very far from where Prince Henri d'Orléans recorded having seen the head of a two-horned rhinoceros in a druggist shop, and approximately six degrees of longitude east of the Singpo country. This indicates that at the time of M. Mouhot's journeys there were probably two species of rhinoceroses to be found in Indo-China and Northern Siam and this also may have a bearing on Lydekker's 'Singpo' rhinoceros.

The Asiatic two-horned rhinoceros has from time to time been divided into two or more species, *sumatrensis* and *lasiotis* being amongst them. Blanford in his 'Mammalia' in the *Fauna of British India* discusses these species and gives the reasons for their designation. He inclines to believe, however, that there is only one species but possibly more than one variety. This is supported by modern nomenclature. In the latest edition of Rowland Ward's *Records of Big Game* it is suggested that there are two local races, one *lasiotis*, embracing Assam to Borneo, and the other *blythi*, the race found in Tenasserim. It is doubtful whether the latter race would vary from that found in Malaya although the Malay.

PLATE II.



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Federated Malay States.—(For details see text).

Peninsula, if *Records of Big Game* is to be followed, holds *lasiotis.*

Lydekker, in his *Game Animals of India, etc.*, 1907 edition, refers to even more than two varieties and suggests that the Malayan animal should be known as *R. sumatrensis niger*, but his premises are, to my mind, incorrect so far as the colour of the Malay animal is concerned. This I will refer to later on.

In *The Field* of the 23rd October 1915, R. I. Pocock wrote a note on the two-horned Asiatic Rhinoceros after having seen two recently mounted heads of this rhinoceros in Messrs. Rowland Ward's showrooms in London.

In this note Mr. Pocock remarks on the difference in the shape of the skulls and states that it would be important to ascertain if the difference is sexual as it was obviously not geographically racial the two specimens having been obtained in the same district. It was not sexual both the animals being mature males. In fact I think it extremely unlikely that the female of the *Dicerorhinus sumatrensis* would ever have such massive horns as are shown on these specimens.

Mr. Pocock refers also to the absence of fringes on the ears of these animals. I do not think that any rhinoceros which reaches maturity and lives in the dense thorny jungle of Malaya could hope to save the fringes on its ears, even if it ever had them. I have seen, in Malaya, a specimen of a baby *sumatrensis*, and it had much hair on its body and ears.

PHYSICAL ATTRIBUTES.

The *Dicerorhinus sumatrensis* is not a very large animal. I think the maximum height for a male would be about 4 ft. 6½ in. at the shoulder this being the measurement of an old male I obtained in Ulu Benus, Pahang. This beast which was stocky and bulky measured 96 in. in girth directly behind the shoulder and 102 in. in length from the end of his nose to the rump, as near as I could measure it. These measurements were taken on a steep hill side so cannot be considered as very accurate. But I have measured other rhinoceroses and the mature animal, whether male or female, has invariably measured more than 4 ft. at the shoulder. One very old female whose molars were worn right down almost to the gum measured 4 ft. 3 in. in height at the shoulder. The measurements of the horns of this animal are given under No. 4 in the table below.

The colour of the *sumatrensis* which has been mentioned as differing from the variety called *lasiotis* and which Lydekker thought was blacker than the northern variety does not, in my opinion, entitle the subspecies *niger* to be recognized. The colour of the hide of the Malayan variety is a dark grey and the underside of the skin, on the belly, under the forelegs, and in the groin, distinctly shades towards pink. The blackest part of the rhinoceros is the horn; even the head is not so dark as the horn. The tail is bare and short, tufted with sparse hairs. The ears, which have been taken as one of the parts which show a difference from the more northern variety, have a very short fringe and a few hairs on the inside, but no mature rhinoceros living in the dense jungles of Malaya, behaving in the way they do, could possibly save long hairs on the edges of its ears. The young rhinoceros is hairy but this hair disappears as the animal ages and only very short hairs, almost bristles, are found on most of the exposed parts of the mature body. A young rhino following its mother passed on one occasion very close to some of my men as recounted later, and it was noticed as being hairy. It was not a baby by any means.

There are two very long horns in the British Museum which are labelled as having been produced by *sumatrensis*. These horns, according to Rowland Ward's *Records of Big Game* measure 32⅛ in. and 27⅛ in. in length, but the next horn recorded only reaches a length of 15 in. That horn came from the Malay Peninsula. The Datok Raja Kiah of Jelebu in Malaya, who is mentioned later on, told me that he had once obtained a *sumatrensis* whose front horn measured about 20 in. in length, but I am afraid I cannot attach much importance to the measurement although it was probably an abnormally long horn. I think that any anterior horn of a *sumatrensis* which measured over 10 in., and any posterior horn which measured over 5 in. should be considered as above the average. The females have smaller and less rugged horns than the males, and seldom show anything but a small development of the posterior horn. In an old male the whole of the top of the nose both around and in front of the horns becomes a mass of horn and at times may develop small lumps which might almost be called subsidiary horns. I have seen two heads with what were almost third horns, and the illustration of the mounted head of a male *sumatrensis* clearly shows a small horny protuberance over the left eye. The horn is merely agglutinated hair and as the *sumatrensis* is very fond of rubbing his horn against trees one can quite imagine that rough surfaces may easily become enlarged into embryo horns? The horn never appears to be used as a weapon, the large incisors in the lower jaw being the weapon of defence and offence.

The following are the measurements of the horns of four mounted heads of *Dicerorhinus sumatrensis* obtained in Malaya. Numbers 1 and 4 are illustrated.

—	Length on outside curve of horn		Circumference of horn	
	Anterior	Posterior	Anterior	Posterior
No. 1 ...	10¼″	6″	18″	16½″
No. 2 ...	9″	broken	22″	14″
No. 3 ...	7½″	4½″	16½″	12½″
No. 4 ...	8½″	1½″	15″	10″

Numbers 1, 2 and 3 are those of males, number 4 that of a very old female with teeth worn right down to the gums.

These measurements can be taken, I think, as typical of the class of horn that was obtainable in Malaya.

The *sumatrensis*, for his height, has a fairly large foot. The greatest measurement of the track of a fore foot that I have recorded was 9½ in. across the widest part which would be to the outer edges of the two lateral toe nails. Measurement of the centre toe nail, in this case, was 3½ in. wide. Another track that I measured of what was a slightly smaller beast was 8½ in. across with a centre toe nail measuring 2¾ in. These were all measurements of fore feet. The hind feet are narrower and the toe nails generally slightly longer. The older the rhinoceros the more he digs his toes in when going up hill, which I believe he must do every day of his life! Anyway he always did whenever I followed him! The result is that his toe nails get shorter as he gets older. The impression of a short but wide toe nail indicates old age. This is in contradiction to the wild elephant which gets down on his heels the older he gets so that his toe nails are inclined to grow longer. The most extraordinary portion of the rhinoceros's external anatomy is his sheath and penis. The sheath points backwards and the result is that when the male urinates he does so behind. This is the only definite clue that can be obtained as to what is the sex of the animal one is following.

The illustration Plate IV shows the sheath and although not very clear it can be seen to hang down like a scrotum. If the male urinates when he is walking or even running he appears to throw his penis backwards and his urine shoots up into the air between his legs. The result is that, when following a track, splashes and drops of urine can be seen on leaves of the bush he has passed through, even up to a height of six feet. One's attention is sometimes drawn to the fact that the animal has urinated, because of the smell which is thus brought so close to one's face. In an article in the *Journal* of the Bombay Natural History Society, volume xxxviii, No. 1 published in Aguust 1935, written by Mr. W. S. Thom on Rhinoceros Shooting in Burma, he states that this phenomenon of urinating on the bushes is done by the female, but I do not think that this is so. I have followed rhinoceroses for too many miles to be mistaken in what I have written above. Several other peculiarities mentioned by Mr. Thom in his article do not correspond with my experience, but I do not wish to criticise further the writings of a very experienced shikari, so I will merely record the deductions I have made from my own observations.

HABITS AND TERRAIN.

In the Malay Peninsula the *Dicerorhinus sumatrensis* was to be found in many parts of the mountainous country and sometimes in the coast belts. The *sumatrensis* is now almost entirely a mountain animal due, I think, to having been driven back from the lower lands. It is, however, very occasionally found someway from the mountains in foot hills or dense low-lying jungle. It lives in the thickest and roughest jungle terrain it can find and that alone, up to this time, has saved it from extermination.

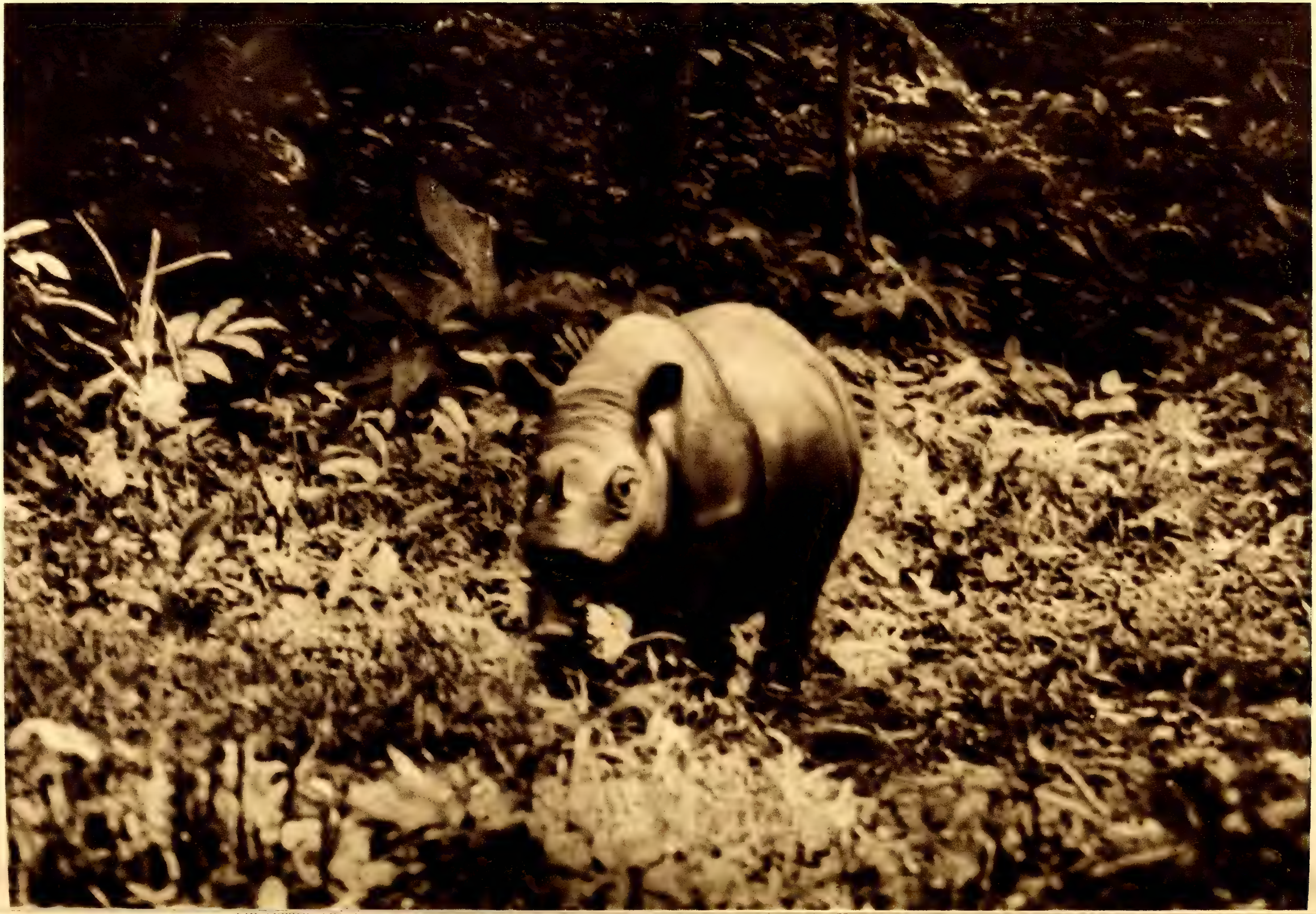
The two-horned rhinoceros seldom travels except alone, it being most unusual to find two of them together.

The Datok Rajah Kiah of Jelebu, an old and experienced rhinoceros hunter, who belonged to a type now passed from Malaya, informed me many years ago that he thought when two rhinoceroses were seen together that they were probably mother and calf except on the rare occasions when two came together for propagation purposes. I have on four occasions followed two rhinoceroses. In one case they were mating but on the other occasions when I came across two they may have been mother and calf, because apparently the calf runs with the mother until nearly full grown. The evidence that I have on the latter point is not very convincing, but taken cumulatively it does seem to point to slow maturity and long association with the parent.

The 'To Raja Kiah caught a baby male rhinoceros which he carefully tended and kept for seven years. I did not see it when it was very young but the 'To Raja told me that it was still hairy when he got it. He shot the mother and found the baby near by. At the end of seven years the rhino had grown to a little over three feet in height: obviously not full grown. It was just showing the anterior horn, but there was no sign of the posterior horn. It foraged in the jungle during the day as it got older, had its own wallows, and returned to the 'To Raja's house in the evening for a feed of rice. When the rice was ready one of the household would call with a loud and shrill, Hoh! Hoh! Hoh! and the rhino would answer from the jungle and come back at full speed for his evening meal. He slept under the house.

I have frequently seen tracks of rhinoceros at least as big as this one following a larger one and I think one may presume that they were mother and calf and that the calf was no longer extremely young. This tends to show that the rhinoceros is a long-lived animal although there is insufficient evidence to be dogmatic about it. The 'To Raja learnt two lessons in connexion with his rhinoceros. He had an offer from another Malay for the rhinoceros but with the usual financial jugglings of such people the 'To Raja was persuaded to part with the young rhino by promises of payment so soon as the purchaser was able to get in touch with his principal who lived some 50 miles away. Foolishly the old man allowed the animal to be taken away. About a week afterwards the would-be purchaser returned with the rhino to the 'To Raja and told him that it was sick and could not proceed any further on the journey. The poor little beast had been dragged along a jungle path, had never been given a chance to wallow, and its skin was cracked in dozens of places. It died shortly afterwards and the 'To Raja had neither his rhino, to which he had been very much attached, nor the money which he expected for it. The two lessons were:—(1) avoid greed, (2) a rhino cannot exist unless allowed to wallow.

As I have written above rhinoceroses have a poor development of the herd instinct and are extremely unsociable. I have followed



Federated Malay States.

rhinoceroses on foot through dense jungles for days and days but have seldom come across more than one animal. Although at times I have followed fresh tracks which crossed the fresh tracks of another animal I have seldom known them to join up. On one occasion when following the tracks of two big beasts another one crossed their trail and followed them. So then there were three. But the reason was obvious, because presently we came to a place where two of them had had a tussle and the third had laid down close by, no doubt wondering which of the two was to be her future lord and master. I hoped I was going to see a rhino fight and followed up the tracks but I was disappointed. I came upon some more traces of struggles and then one of them went away and left the two to continue their honeymoon. Perhaps it was the lone male which had intruded into the party and which now took up the running? I do not know, but I do know that the solitary one which I went after, it being easier to deal with one animal than two, was a very old male with his posterior horn broken off. This animal is mentioned on page 598 and is No. 2 in the list.

Of all the difficult and exasperating animals to follow through dense jungle the rhinoceros easily takes first place. They invariably go through the thickest undergrowth they can find and deliberately leave a game path to go through, or under, or over, some fallen tree which appeals to their sense of humour, I suppose. They do this normally as recreation when going about their lawful occasions, but when once wise to the fact that they are being followed they excel themselves in ingenuity. Nothing is too difficult for them. I remember once tracking a rhinoceros up a steep hill side in very rough country with many rocks about. We came up to him almost on the top of the hill. He heard us, I suppose, and turned round to face the direction we were coming from, but carefully put a large fallen tree and a dense thicket of rattan between himself and the line of our approach. We could see nothing, but were suddenly brought up standing by a tremendous snort just in front of us. Then a short rush away from us—cessation of all sound, and another magnificent snort, more like an engine blowing off steam than anything else. This was followed by a shrill squeal, denoting that he had smelt us and away he went crashing through everything. We saw nothing at all. He rushed down a dry gully and when we followed painfully in his rear—by that time he was far away—we found that, when tearing down this dry water course which was full of granite boulders, he had come to a place where the formation broke away to a sheer drop of twenty feet. This did not bother him, he just took it in his stride, nor did the flat slab of granite at the bottom on which he landed check him in any way, he had continued his rush as if nothing out of the ordinary had happened. The drop to this granite bed would have seriously injured if not killed any other heavy animal, but a rhino is the toughest animal on earth. His short leg bones enable him to do these things without much inconvenience. We followed him up for some miles before he stopped, apparently to amuse himself by rubbing his horn against a tree, taking off rather more bark than usual, and kicking up a greater amount of earth at the foot of the tree than is customary. That was the only indication that he remembered that granite bed rock. And so it is always with them. They seem impervious to any physical feeling of discomfort. Their walking powers in bad country are phenomenal. I have often followed up a rhino which has laboriously climbed—I should say we have laboriously climbed—a high mountain merely to go down the other side. A rhino that has been scared may do this two or three times during a day without stopping, except to take a quick wallow if he comes across a mud hole, and, at the end of the day, the unfortunate people following him will be perhaps far enough behind him to take two or three days to catch him up. The hunting of rhinoceros by tracking is a very difficult business and, if that was the only way to get them, then the rhino would have been in no danger of extinction. But unfortunately the rhinoceros with all his highly developed senses will continually follow the same game trails, especially near wallows or near salt licks, and it is due to this habit that they have been so persecuted. Even to this day, one finds rhinoceroses' game paths passing alongside some long disused and partially filled-up pit, showing their extraordinary obsession for keeping to and following almost the exact paths which generations of rhinoceroses have used. This has resulted in pits being dug on their accustomed trails by poachers anxious to obtain their horns. I have described the procedure later on.

When travelling through the jungle on their ordinary rounds rhinoceroses move slowly and steadily covering a great deal of ground during the twenty-four hours. But occasionally finding some particular patch of jungle that he likes, a rhinoceros may hang about in the vicinity for some days. They particularly favour the heads of narrow valleys, where they generally have well used wallows, plenty of thick undergrowth and nice precipitous sides to the valley to give them plenty of exercise. An ideal place for a rhinoceros to frequent is jungle so dense, that a man can see nothing within five yards except a wall of forest, and so steep that he cannot walk without holding on to something, which something will almost certainly be thorny. Another delightful type of jungle favoured by rhinos is one interspersed with the large bamboo known to Malays as *buloh semeliang* (*Dendrocalamus giganteus*). This bamboo grows quickly and to a great height. Not having much rigidity, much of this bamboo leans towards the ground while still alive and, on steep hill sides, thus presents an almost impenetrable tangle. But the rhinoceros does not bother about this; he goes under the bamboo letting the tangled mass pass over his back. This bamboo fractures easily leaving an edge as sharp as a razor which will cut to the bone with ease. To follow a rhinoceros along a steep hill side where he has passed under *buloh semeliang* is a very ticklish business and if your party gets through without casualties you will have done well. I have seen an elephant's trunk cut very severely by one of these bamboos when he was rushing down a hill after getting a taint of human scent. But they do not bother the rhinoceros; in fact, nothing, except human scent, seems to worry them. They go about their business without fuss or haste.

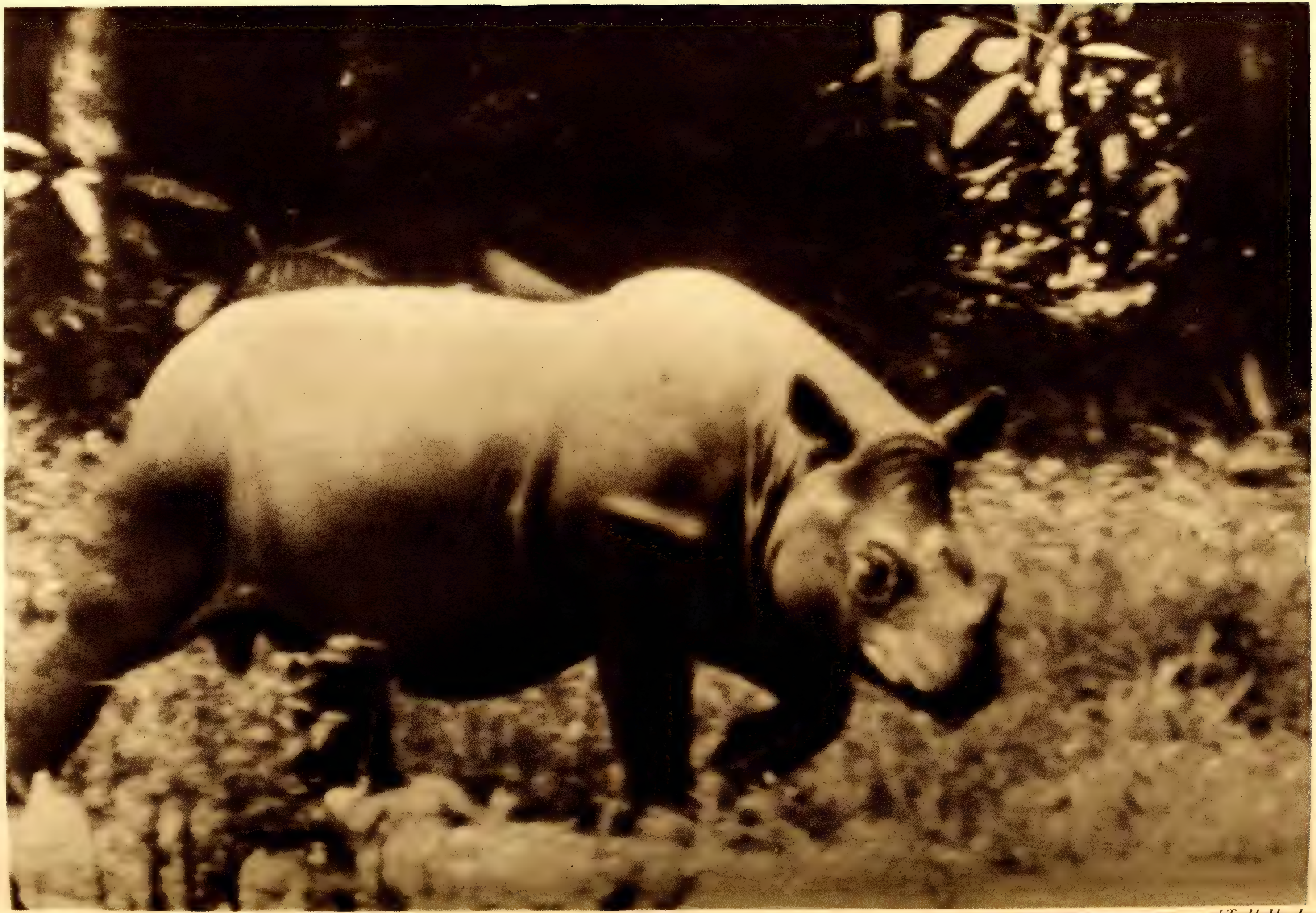


plate III.

To follow rhinoceroses with the hope of making observations or watching their movements is extremely difficult and few opportunities ever come one's way.

There was an old rhinoceros in a very remote part of the Malayan jungle of which I wanted to make an intensive study. I tried to. I followed on his fresh tracks for an accumulative period of forty days, spread over five separate expeditions after him. I heard him three times, was very close to him several times but saw him never. His habits were fairly regular until he became alarmed and then he was the cunningest thing in the jungle. The country he frequented was not high but extremely steep and covered with thorns of many sorts. The worst obstruction was a palm called by Malays *chuchor* (*Calamus castaneus*). It grows in dense clumps to a height of about ten feet, and is very thorny. This palm jungle was interspersed with rattans of several varieties and most of the terrain followed by this rhino, when he was alarmed, was along steep hill sides heavily wooded and covered with *chuchor*. Directly he knew he was being followed he tried every trick known to rhinos to give us the slip. He never stayed for any time in his wallows—to make up for that he wallowed frequently—and he continually made huge circles coming back on tracks about once in two days. One day he came close to a camp which had been used by us two days previously. Some way off, he became aware of the proximity of the old camp and stopped before he came to the banks of the river which separated him from our camping place. He then turned back and went in another direction. His habits seemed to indicate that he was very old. He had a track which measured 9½ in. across, exceptionally wide for a *sumatrensis*, with short toe nails. He also had little control over his urine, when alarmed he had an almost continual dribble for a mile or two. But I have noticed, on other occasions, that rhinos when alarmed and panicky would do the same thing, but they did not go on for half an hour as this old fellow did. He never ran far but he never seemed to stop. A fast walk which he could keep up for miles defeated us. When we did get up to him and he got away without our seeing him—that was always—we knew that it would be two or three days before we would have a chance of getting close to him again. We used to track him all day, camp on his tracks at night, and off again early next morning; still he defeated us.

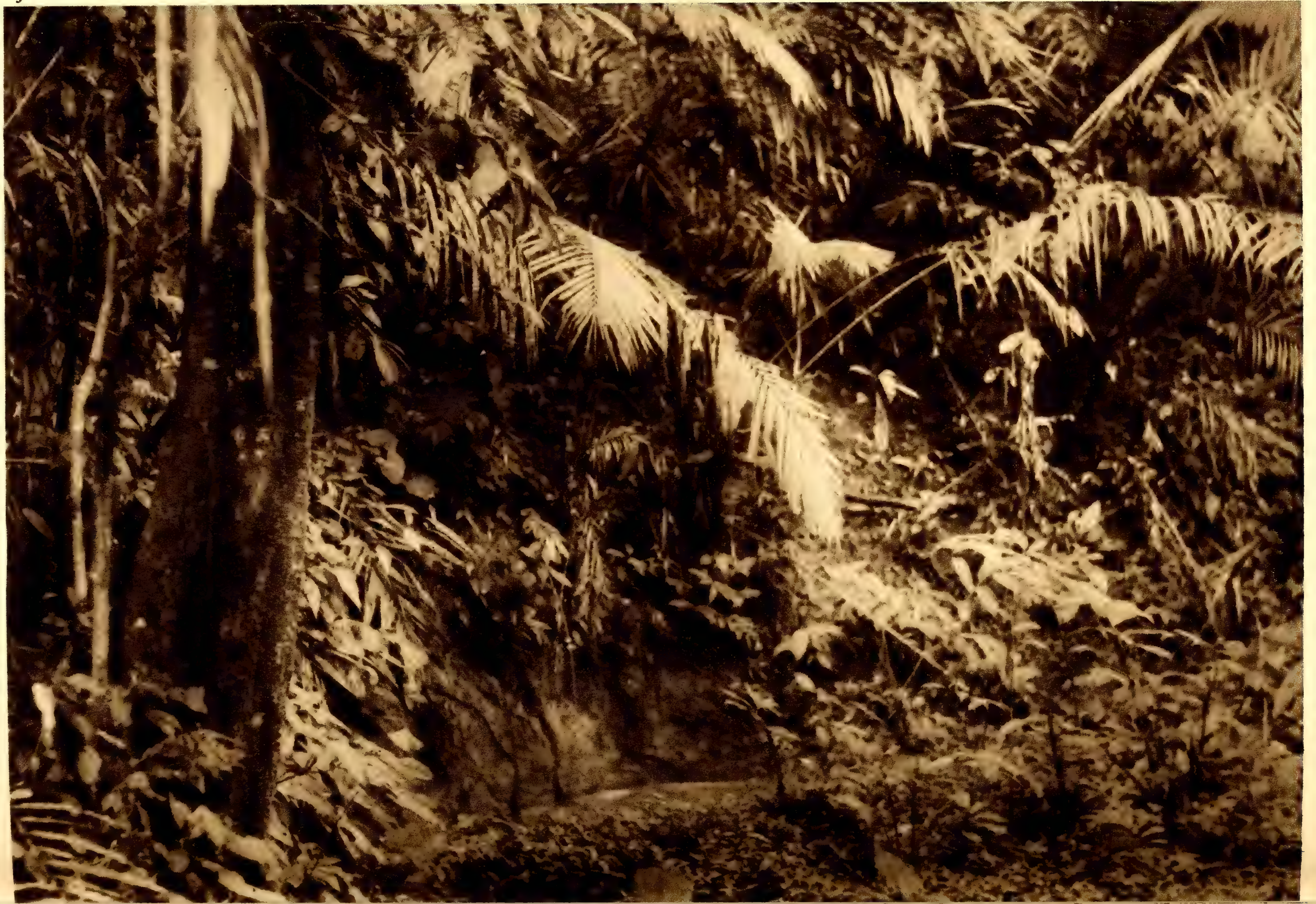
His food consisted chiefly of twigs of the trees sought by rhinoceroses, which indicated that his teeth were much worn. Generally they chew up more of the trees they push down than just the slender twigs. He found and demolished large quantities of jungle fruits which were easy to swallow, which he did stones and all, but his digestion was all right because they never seemed to upset him. A favourite trick of his was to get into a river and follow it for half a mile or more; he would then find a place well concealed on the bank and leave the river by climbing over stones or roots or something which would be difficult for us to spot a day or two afterwards. I remember following a rhinoceros which went down to a river and first walked about half a mile upstream, then about a mile down stream, then back again for about a quarter of a mile upstream to the mouth of a small stream which was full of large stones; he walked on these stones until he was well away from the main river, climbed the bank and disappeared into the jungle. This manœuvre delayed us the best part of a day. The account of following the old rhinoceros has not been an exception to the rule, it is merely a good instance of what the rhinoceros can do when it really tries to get away from the nasty smell of man.

All rhino are very fond of wallowing. As I have already written it is essential for their very existence that they should be able to wallow. Their hides are extremely thick but the epidermis is thin and sensitive and the number of flies that follow them no doubt irritate them and make their habit of wallowing a very natural one. Normally the rhinoceros wallows once or twice in the twenty-four hours, more in hot, dry weather. It is also fond of walking and swimming in the rivers. I have never seen any evidence of them lying down in the rivers although they invariably lie down in their wallows. The wallows are generally situated under a bank, sometimes in a swamp. Wallows under banks are made in such a position, I believe, because the rhinoceros likes to dig into the bank with his horn. This is done, I presume, to make the mud in the wallow of the right consistency, because after heavy rain the mud would be very thin and would probably not stick sufficiently to his hide; so he thickens it up a little by breaking down the bank with his horn or with his fore feet, but more usually his horn. The banks become hollowed out as the illustration shows (Plate V).

Before the days of intensive rhinoceros destruction in Malaya it was possible to find a regular battery of rhinoceroses' wallows in one place, as many as seven or eight would be found under a bank and all in use. At one salt lick in Ulu Pahang, a salt lick well patronized by rhinoceroses in their palmy days, I found no less than five large wallows in a series, almost touching each other. Near another lick were eight. They are no longer used. To adapt two lines of Tom Moore's poetry one might well say:—

The pits are still there
But the rhino have gone.

I have known a rhinoceros which had been disturbed, to wallow as many as six times during the day, remaining only a few minutes in each wallow, rolling about to get himself thoroughly covered with mud and then going on again. In one place, he had obviously thrown himself into the wallow, probably hot and bothered, because the mud was splashed everywhere in the vicinity. On another occasion when following a rhinoceros in very rough country, too rough even for him to find a wallow, he actually tried to wallow in a little stony gully with about two inches of water at the bottom. As a wallow it was not a success. I think that their necessity to wallow must be very great otherwise alarmed animals would not be so anxious to perform the rite. Possibly the sensitiveness of their skin demands a coating of mud, although that is scarcely consistent with their fondness of going through all the thickest and thorniest jungle they can find. Flies certainly



A wallow of the Asiatic two-horned Rhinoceros—*Dicerorhinus sumatrensis* (Cuv.)—near a 'salt lick.'

bother them, especially a large unidentified kind of *Tabanus,* with a blue abdomen. They are also attacked by a special type of tick which is the only jungle tick that I have come across which will with ease drive its mandible through thick shikar cloth. Of course compared with rhino hide this feat must be nothing to it, but the ticks which attach themselves to the wild cattle of the Malayan jungles cannot do it. The ticks appear to fall off the rhino long before they are gorged, in fact at times I have seen rhino ticks on the trail followed by a rhino which had evidently not had a meal at all, and yet I believe that they must have come from the rhino's body.

Most of the salt licks affected by rhinos are sulphur springs which are generally situated amongst rocks. These rocks are polished quite smoothly by the animals using these licks. For many years I thought that these polishings were the result of the licking of the rocks for some inherent benefit in the rock itself. I subsequently found out that the rocks are licked to remove from the lips or mouth of the animal a peculiar type of small leech, akin to the horse leech, which lies in the slime of the sulphur water. When an animal puts his muzzle down to drink the leech secures its hold. I first noticed this fact whilst watching a tapir in a sulphur lick and subsequently often saw sambhur deer do the same trick. I have a cine film showing quite clearly a sambhur stag rubbing his lips on the rocks after taking a long drink at the sulphur water. The rocks are also polished by the animals' bodies, as well as in the process of removing leeches from their mouths and lips. It is not surprising that centuries of such contacts have smoothed over all the rocks in the vicinity of a lick.

Rhinoceroses also visit mud-licks which show no exudation of sulphur but probably contain some trace of sulphur or possibly a saline which attracts them. There is I think no doubt but that wild animals visit salt licks for the purpose of cleansing their stomachs and intestines of parasites. Wild cattle droppings will be almost pure mud after a visit to a mud-lick, and I have often come across the dung of elephants slimy and covered with mucus after a visit to a salt lick.

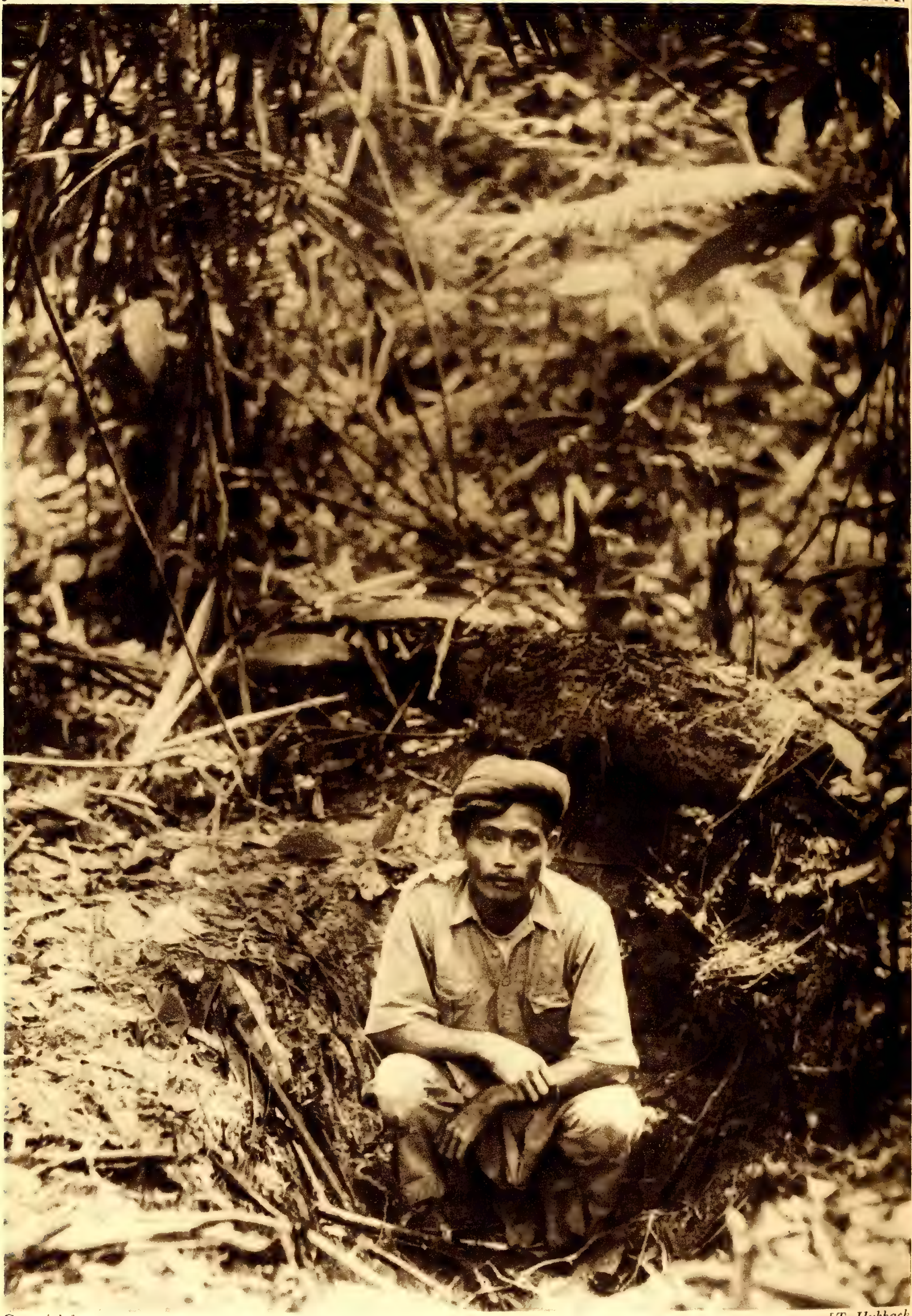
SENSES.

The senses of hearing and smelling in *Dicerorhinus sumatrensis* are extraordinarily acute. The enormous nasal cavities surely enhance its power of scent. The habit that this rhinoceros has of curling up its pointed upper lip when testing the wind is no doubt an effort to utilize more of the inner surface of the nostrils in trying to discover the direct line of scent. A rhinoceros, once he has decided that the wind is tainted, wastes no time in getting away and, as I have described elsewhere, he voices his fear in no uncertain manner. I have no doubt but that the rhinoceros relies more on his nose than any other organ to give him warning of danger. His hearing is also very acute, despite the fact that he has small ears which do not look as if they would be capable of catching much sound. The Datok Raja told me that, when approaching a rhinoceros, on no account to break anything along the side of the trail, except the smallest twig, if it was necessary to mark the route, because a rhinoceros could hear so extraordinarily well that he would be put on guard and would immediately start to test the wind in every direction. This is sound advice although a little difficult to follow along a steep hill side with a thorny rattan holding one back by the lobe of one's ear!

In the dense jungles favoured by rhinos there is little movement in the air, except during a storm, and I have no doubt but that the rhinoceros with his extraordinary powers of smell would detect human scent from almost any direction if sufficiently close to him even on the stillest day. Their sight is poor, in fact probably of little use to them for detection purposes and can be ignored when stalking them.

The rhinoceros has several distinct methods of expressing pleasure, annoyance or alarm and uses both his throat and his nose to give vent to his feelings. It is interesting to know that a rhinoceros when alarmed has a very distinct way of showing his fear as against an extremely truculent demonstration when only suspicious. As I have written already, a suspicious rhinoceros will face the direction where he thinks there is something out of the normal and then give vent to a terrific blast from his nostrils. He may then turn round and trot away a few yards and repeat the performance. It is merely bluff. When he gets a taint of your wind his attitude immediately changes into one of abject fear. Of all animals I think the rhinoceros must hate the scent of man most. Possibly it is due to his being so seldom confronted with it, that to him it is the most horrible smell on earth! Occasionally a rhinoceros when suspicious will turn round and run away without any vocal display, stopping in a short distance to listen intently. It is then very difficult to approach him because he will keep absolutely still and one is liable to almost run into him. But when he gets one's wind the procedure is very different. The animal immediately goes off at full speed in any direction—if facing you he is liable to run straight in your direction—making a noise something between the bark of a dog and the quack of a duck. It is not exactly a squeal but a noise peculiar to a thoroughly alarmed rhinoceros. The intensity of the quacking will generally indicate the distance he will go before he slows up. When hunting in the mountains, I used to despair when I heard a rhino rush away making a series of long and plaintive quacks, knowing perfectly well that it would be days before we would be able to catch him up. On the other hand, if alarmed, he snorts violently and then rushes off; but he will nearly certainly pull up within a hundred yards or so, probably wondering what had disturbed him.

When feeding and quite undisturbed a rhino will continually squeak and talk to himself making some of the noises through his mouth and some with his nose. These noises can be heard for some distance. I have never heard them after a rhino has been disturbed, although followed all day. Apparently he only makes these noises when he is completely at peace with everything. There is a peculiar noise that a rhinoceros makes when in a wallow,



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A disused wallow of the Asiatic two-horned Rhinoceros—*Dicerorhinus sumatrensis (Cuv)*

This is a quite distinctive sound and not at all like a rhinoceros. The first time I heard it I was with the old Datok Raja and we could hear a rhino splashing about in a wallow but could see nothing. Presently I heard a noise which I took to be made by a monkey, probably a gibbon I thought. I whispered to the Datok that there was a monkey evidently close to the wallow who had spotted the rhino and that we must be careful that he did not spot us too. The old man smiled and shook his head. 'That is the rhino; they make that noise when enjoying themselves in a wallow.'

I often heard that noise on other occasions and was often hard put to it to believe that it really was the rhino and not a gibbon. The sound was low and rather plaintive, something like the low note of a white-handed gibbon, but also with a faint resemblance to a bird. A noise impossible to describe accurately. Finally a rhinoceros will squeal terribly when dying a violent death, not unlike the screaming of the sambhur deer under similar circumstances, but an even more distressing sound.

In addition to noises which present some sort of endeavour to express its feelings there is a complete series of snorts and grunts and blowings which the rhinoceros sometimes gives vent to when wallowing, probably due to trying to get the mud out of his nose and eyes. But generally speaking, they do not make much noise when settled down in a wallow for a good rest. When lying down on the ground, and probably also in a wallow, they never, I believe, lie on their sides, but fold themselves up with their legs tucked under them.

FOOD.

I do not think that *Dicerorhinus sumatrensis* ever graze; I have never seen any evidence of them doing anything of the sort. They eat fallen fruit and so far as that goes do take food off the ground but do not appear to eat grass or roots of any sort. Their principal food is the small branches of certain trees, and bitter or astringent fruits. I have once seen a rhinoceros eating lichen, or possibly some fungus off a fallen tree, but their main food supply is from young trees that they break down. Whereas the other species of large wild life in Malaya will often find food in secondary jungle, the *sumatrensis* invariably feeds only in virgin forest or very old regenerated jungle. They seem to feed indiscriminately, that is to say they do not appear to have any regular hours, although they do frequently sleep during the heat of the day. They may however wallow at any time.

Rhinoceros are particularly fond of trees of the SAPOTACEÆ family, some of which are enumerated below. Other trees and fruits which they eat are included in the following list. The native name is given in brackets.

Trees and Fruit eaten by *Dicerorhinus sumatrensis*.

ANACARDIACEÆ. *Mangifera* sp. (Machang berlawin) fruit eaten.
APOCYNACEÆ. *Dyera* spp. (Jelutong).

EUPHORBIACEÆ. *Sapium baccatum*....(Memaya).

GUTTIFERÆ. *Garcinia* spp. (Kandis); *Kayea Kunstleri* (Gaha).

LEGUMINOSÆ. *Pithecolobium* sp. (Keredas); *Saraca* sp. (Tengelan), flowers eaten.

MYRISTICACEÆ. *Myristica* spp. (Penarah).

MYRTACEÆ. *Eugenia* sp. (Kelat merah, kelat kuning, etc. etc.).

RUBIACEÆ. *Urophyllum* spp. (Manai badak, manai pahit, manai rumpah).

SAPOTACEÆ. *Palaquium* and *Payena* spp. (Nyatoh, several varieties); *Payena costata* (Mengelut or Salut), fruit eaten; *Palaquium Gutta* (Taban merah, etc.).

Of the many species of *Eugenia*, which are common in the virgin forests of Malaya, young trees are often broken down and the smaller branches and leaves eaten. Many trees containing gum or getah are favoured by rhinoceroses. *Jelutong* seedlings they are fond of. The gum from large *jelutong* trees is the principal ingredient of chewing gum. The several species of the shrub *Manai* which grow in patches on hill sides are often eaten down by rhinoceroses which are very fond of the bitter leaves.

The principal jungle fruits that they are fond of belong to the genus *Mangifera*, as well as the fruit of a tree called *Mengelut* or *Salut* which has a thick sticky creamy juice, no doubt palatable to the rhinoceros. Once when following a *Rhinoceros sondaicus* on the coast of Tenasserim, Lower Burma, I found that the animal had eaten large quantities of the bark of a tree, *Ceriops Candolleana* which grows in mangrove swamps and in tidal water. It has a bright orange inner bark and it is, I believe, used for tanning. The urine of this rhinoceros was stained bright orange by the juices in the bark and dried on the leaves like small discs of gelatine.

The rhinoceros obtains most of his food by breaking down small trees, pushing against them with his forehead or chest until the tree is sufficiently bent over to enable him to walk it down by pressing the tree under his belly. Sometimes when the tree is fairly large he puts his fore feet on it to bring more weight into play. He may even hold a tree down by standing on it with his fore feet; I have often seen the marks of his toe nails on the trees that have been broken down.

Having defeated the tree, the rhinoceros proceeds to eat the twigs and small branches. He will move round and round the end of the tree continually altering his position during the process of demolishing the leaves and ends of the branches.

A favourite trick of the rhinoceros when feeding is to get a sapling behind his front horn and twist it round and round until it is thoroughly decorticated and covered with mud from his head. I do not know exactly how this is done never having caught a rhino *flagrante delicto*; but it is generally supposed that this is only done by a rhinoceros which has sufficiently long horns to enable it to twist the saplings between the two horns. I found that this was not the case. In one instance I was following a rhinoceros which had twisted a number of saplings but discovered later that it had a very poor and stumpy posterior horn. Also, I believed, for the same reason, that a female rhinoceros could not twist saplings and, when following rhino's spoor and finding twisted saplings, I concluded that I was on the track of a male which had a good horn. I disproved this by finding saplings twisted in approved style by a cow rhinoceros which was accompanied by a calf. I do not now believe that the length of the horns has anything to do with the thoroughness of the twistings and such indications are no guide either to the sex of the animal being followed or the size of the horns.

Another favourite trick of the rhinoceros is to rub his horn against smallish trees and take the bark off. This is frequently accompanied by pawing up of the earth at the foot of the tree and the sprinkling of the surrounding shrubs with urine. In this case there is generally some indication of the type of horn possessed by the rhinoceros: an old rugged horn will knock large chunks of bark off; a young horn will merely plane the bark off. Much disturbance in this way to the tree and the ground around it will almost certainly indicate a male rhinoceros. I think that the pawing up of the ground may show that there is some sexual connexion between the rubbing of the horn and the disturbed earth which is spread about in all directions, no doubt some of it being directed against his sheath. Female rhinos do rub their horns against trees in a similar fashion but I have never noticed that it has been accompanied by pawing.

General Observations.

Rhinoceros frequently defecate into water but also on land. I have only once seen a place where a rhino had returned to a particular spot to defecate. Their droppings consist of round balls rather larger than a cricket ball in the case of a mature beast. It is impossible to tell the female from the male fæces. The fæces of an old animal will contain coarse and only partly digested twigs, no doubt due to defective or much worn teeth. Often during the fruit season their fæces are full of the stones of jungle fruits, unbroken but clean of all fibre. Thus does the rhinoceros spread trees, useful to himself and other animals, throughout the jungle. I have often seen young *Mangifera* seedlings growing out of an old accumulation of rhinoceros dung.

A rhinoceros will never defecate in a wallow or a salt lick; at least I have never seen any signs of one having done so. An elephant will defecate in a salt lick and foul the whole place for any other animals, and even seladang (*Bibos gaurus*) are known to occasionally offend in this way.

I am afraid I cannot write much about the young of rhinoceros. I have sometimes come across their tracks but have only once been very close to a rhinoceros calf. All my men saw it but I did not.

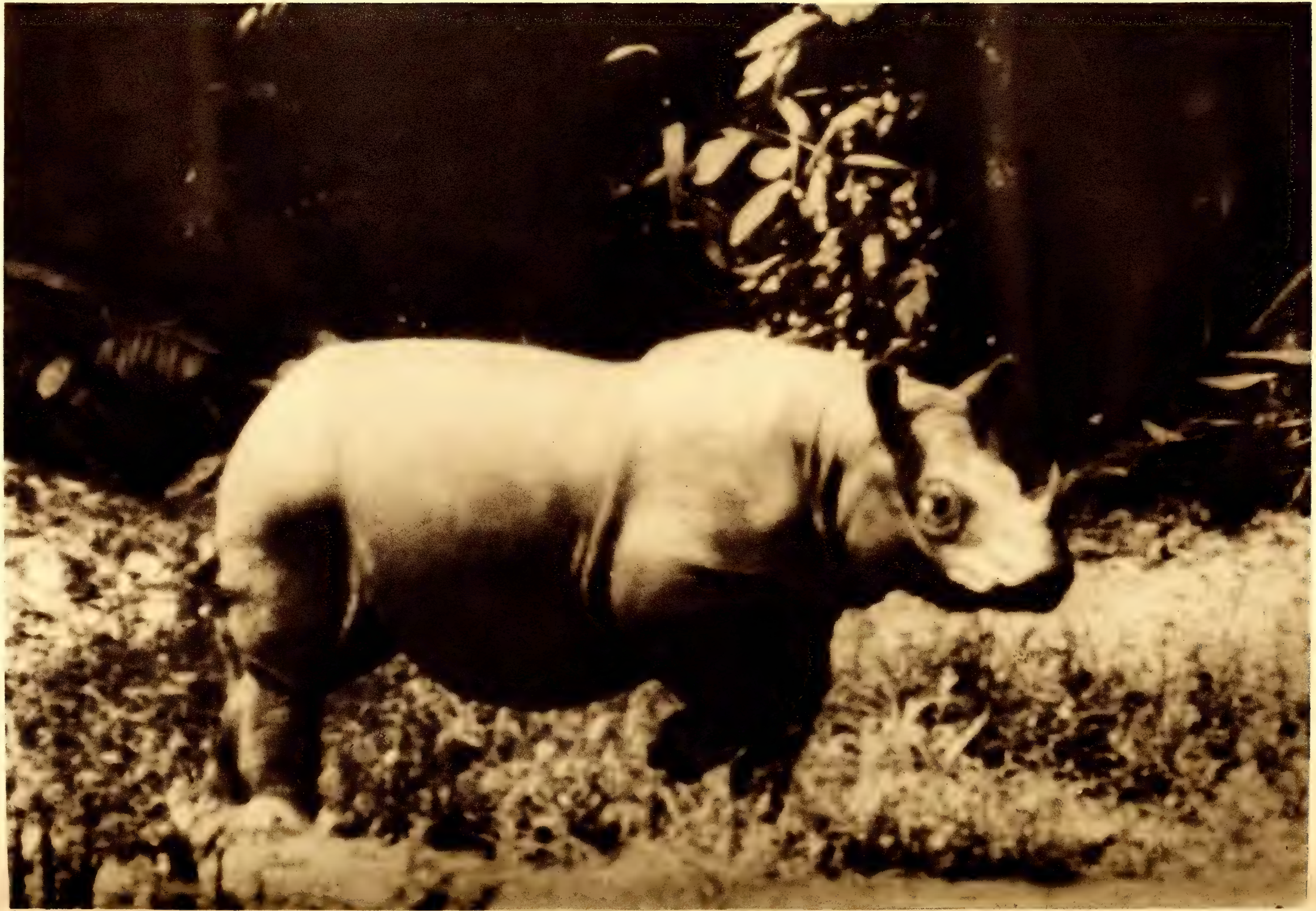
We were looking for the tracks of the old rhinoceros mentioned earlier and had been following along a game trail on the top of a narrow ridge. The ridge dipped and then climbed again. I was ahead with one man, and some way behind were six Malay carriers and behind them six Sakai, the aboriginals of the Malay Peninsula. Presently we crossed a fresh track of what was obviously a large rhino. The lateral toe nails were far apart and I mistook the track for that of the old male. The wide spreading toe nails of this rhinoceros should have indicated to me that they were the tracks of a big female and not those of the old male I was looking for. I had noticed this trait before and think that it is due to the result of an ageing body and flabby muscles of the foot, which may not be so pronounced in the male. I think the track of a large splayed foot may be taken as an indication, but only an indication, when following the spoor of a *Dicerorhinus*, that the animal is a female. The tracks were very new and I sent my companion back along the trail to stop the carriers, natives cannot restrain their chattering and I did not want them to upset the whole business. While my man was on his way back, I heard directly below me the breaking of a tree and then the swishing of some branches. That was the rhino. I started to move nearer the edge of the ridge but before I had gone five yards the rhino became aware of my presence and rushed off. I was well above it and the wind should not have played me such a dirty trick. The animal made a low squeaking noise and ran back towards where my men were. Soon I heard weird noises and then cries of alarm from the Sakai. It all happened too quickly for any of the men to realize what was happening. I had not far to go to find them. The rhinoceros, which was a female followed by a calf, had run right between them. I heard stories of bravery which, knowing their characters, astonished me!

Apparently the rhinoceros having got my scent rushed back more or less on the level until it came out on the game path just in front of my Malays who were plodding along the narrow ridge. The rhino had nowhere else to go so just carried on. The men who had stopped, having heard something coming towards them through the jungle, scattered to each side of the ridge, no doubt looking for suitable trees to climb, but before they could do anything the rhino had passed. The same thing had happened to the Sakai who had rather more time being a hundred yards in the rear and some of them were up trees when the rhino passed them.

What interested me was the calf. I questioned the Malays and Sakai very closely regarding the position of the calf, and those that observed anything more than the bole of a tree told me that the calf was so close to its mother that its head was almost entirely hidden between her hind legs. I extracted this information when inquiring if they had seen whether the calf had any signs of a horn. One of the men said that he distinctly noticed that the calf showed a good deal of hair on it and they all said that the cow proceeded at a slow trot and was blowing hard. They also said, which I confirmed afterwards by examining the tracks, that the calf was not a very small animal.

The route taken by the rhino was a perfectly natural one and was more or less in the direction it was moving when I disturbed

PLATE VII.



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[*T. Hubbach*

The same animal shown in plate III.

it. But had this incident occurred when I was not there it would have been described as a desperate charge and still another story of the ferocity of the rhinoceros would have come into being. The track of the rhino along the ridge showed that she had followed more or less the centre of the path and, for all she cared, the men might not have been there at all. Her main object was to get away from my smell!

I examined the place where the rhinoceros with her calf had been when I disturbed it. There was a wallow there which was very nearly dry but they had been stamping about in the mud. Here the cow had twisted up a small sapling in approved style. My men had noticed merely a small anterior horn on the cow and no signs of a second horn at all.

The tracks of the calf which were very faint on the ridge were very visible in the drying mud of the wallow and were those of a young, but not very young rhino. It is very difficult to spot the tracks of a calf, when with its mother, as generally it keeps either just in front and so has its tracks covered by those of the larger animals or follows close behind stepping into the depressions made by the mother's feet. The dung of a calf is hardly ever seen; I saw some on this single occasion. It was near the wallow. Datok Raja told me that the mother covers up the dung of the calf with her own dung, and the only way to find the calf's droppings is by moving those of the cow very carefully to see if there are any small-sized fæces underneath. I give this for what it is worth; native observations of this sort are not of much value.

The rhinoceros has three toes on each foot. The only other animal in the Malayan jungle that has three toes on its hind foot is the tapir. But the tapir has four toes on his fore foot, so its tracks should not be confused with those of a rhinoceros, but when tracking is difficult, and the fourth toe of a tapir obliterated by the track of its hind feet, mistakes can be made except by experienced trackers. The tracks made by a rhinoceros are not easy to follow. Its large spongy feet press down leaves which spring back to their original level and only faint indications may be left by the toe nails. An old track of a day or two may easily be confused with a new track, especially during dry weather. Heavy rain will almost completely obliterate rhinoceros's tracks at times, and it is often terribly disappointing after a long day's tracking to have a night of heavy rain and know that a long, difficult and tiring day is ahead of one until such time as the rhinoceros has reached some spot, probably miles away, when the rain had ceased.

There is one great help to the tracker and that is the rhinoceros's habit of wallowing. His hide is always dirty. As I have written, the only other animal whose tracks in any way resemble a rhino's is the tapir and an oldish track of a large tapir which had been perhaps partially washed out by rain might easily be mistaken for that of a rhinoceros. Since the tapir never wallows a careful examination of the saplings or trees that the animal has rubbed against will soon show traces of mud or a mud smear if the animal is a rhinoceros.

POACHING.

If salt licks have been a benefit to the rhinoceros they have also spelt his doom. Their habit of making periodical visits to salt licks has enabled poachers to set traps for them along the many game trails which lead to these licks. In Malaya, there is little trapping of rhinoceroses done now for the simple reason that rhinoceroses are very few and far between. But a few decades ago there was a regular business done in pitting for rhinos and hundreds must have been destroyed.

I have travelled a great deal through what was once rhinoceros country and have found dozens and dozens of old disused pits. Most of them were in the vicinity of salt licks, but some in places where there were well defined trails.

At one lick I found no less than 18 of these pits and I certainly did not find all the pits that had been dug. They were twenty to thirty years old. So many pits indicate a large rhinoceros population. There are none there now at all, although this is in an entirely unopened part of the country. At another well known salt lick I found eleven old pits, but on one side of the lick I did not make a careful investigation. This lick is still very occasionally visited by rhinoceroses, but every year their visits become less. In this lick I found, a few years ago, a shooting platform recently constructed, no doubt with the hope of getting a pot shot at a rhinoceros. At another lick, in quite a different part of the country, about twenty years ago, I found that a fence had been made covering each game trail into the lick and a spring bamboo spear placed so as to command a small opening left in each piece of fence. This was the work of Sakai, an aboriginal predatory tribe who do much damage to wild life in some places.

These pits, of which I give an illustration (Plate VI), were made with much care, every trace of the activity of man being removed. There was no difficulty in finding where to make a pit, because there were numerous game trails leading to these salt licks and, in the old days, these trails were regularly used. Such a pit is about seven feet deep, nine to ten feet long, and three to four feet wide. It is so constructed that when a rhinoceros falls into it he is wedged between the slightly sloping sides of the pit and thus kept from reaching the bottom with its feet. A big animal would thus be tightly held by its own weight and entirely helpless. The chances of its getting out are very small, unless it fell so that it could get its head into the sides of the pit, when it would probably be able to dig itself out. In the north of the Malay Peninsula, I understand, that the pits used were lined with round jungle rollers of hardish timber so that there could be no question of an animal being able to dig himself out, but I have never seen any signs of any lining to any pit in Pahang where most of the pitting took place. In selecting the locality for a pit hard soil was searched for, and generally the pit was made on the side of a hill along which ran a game path. Every particle of earth removed from the pit is carried away for some distance and no trace of it was left near the spot. I think that this was more to remove the scent from the earth in which the poachers had been working than to avoid the chance of the rhinoceros noticing a change in the landscape, because the rhinoceros has very poor eyesight. A fascine of jungle saplings would then be made and placed over the pit, the entire place being covered up with earth and leaves until it looked exactly like any other part of the game trail. I do not think that the poachers visited the pits very often, the extreme sensitiveness of the rhino's nose making it imperative that as few visits should be made as possible. But, so long as the poacher was satisfied that his work had been good enough to assure the capture of an animal falling into the pit, that was all he cared about. What did he care for the sufferings of the unfortunate animal? From what I have gathered these wretched animals very often starved to death. Under such circumstances only the horn would be taken and if the animal was an immature one quite possibly there was nothing to take at all.

Although the pit was the commonest and the most deadly way of obtaining rhinoceroses other methods were adopted. A platform made in a salt lick was one, but this was, I believe, a not very satisfactory business because in those days there were no electric torches and a rhinoceros would seldom come into a lick during the day time. The *belantek*, the spring bamboo or steel spear, was sometimes used as I have already mentioned, but the device was not so certain as the pit, although other animals,—a deer or a seladang might be thus added to the bag.

The tracking of rhinoceroses was seldom undertaken by poachers, although an experienced hunter, like the Datok Raja, used no other method. In fact he told me that, when persons started pitting in the Negri Sembilan where he lived, he gave up hunting rhino in disgust. He complained bitterly that pits very soon drove all the rhinos out of the district and described with scorn the methods of people who were only capable of getting a rhinoceros by digging a pit for it.

The tragedy of the whole thing lies in the fact that the *Dicerorhinus sumatrensis*, one of the cleverest, cunningest, sturdiest and most harmless of jungle animals should be driven from the face of this earth by superstition and greed. For years, in Malaya, this rare animal has been protected by laws which being ineffective are merely marks on pieces of paper, with the result that nothing practical has been done to try to save it from extermination.

COMMERCIALIZED SUPERSTITIONS.

There has been for many decades in Malaya a demand for horns and other parts of the rhinoceros due to the fact that Chinese shop-keepers and others have always been willing to pay big prices for such articles. In fact, I have known of Chinese who financed poachers, or at any rate would be willing to give them credit for provisions for a horn not yet obtained.

This stimulated the business and it went on steadily for many years until the *Dicerorhinus* has been brought to the verge of extermination.

In Northern Pahang, the largest of the Federated Malay States, and the least developed, a tremendous amount of destruction was done to the rhinoceros population at the beginning of this century, despite the fact that from 1896 there was a law in Pahang making it a punishable offence for any person, who was not licensed so to do, to capture, kill or wound any rhinoceros. Not that anyone was either licensed or punished. These poachers were not hampered in any way by an enforcement of the law and the inertness of the Government must be considered as a contributory cause for the disappearance of the rhinoceros.

Many years ago, I had the following conversation with an old Malay on the disappearance of rhinoceros from much of the country where we were at the time. I had been for some weeks trying to locate rhinoceroses but without success.

'What,' I said, 'has become of all the rhinos?'

'I do not know,' he answered.

'Do you remember if there were many here during your youth, because there must have been many at some time or other according to the number of game trails I have seen which were obviously made by rhinoceroses?'

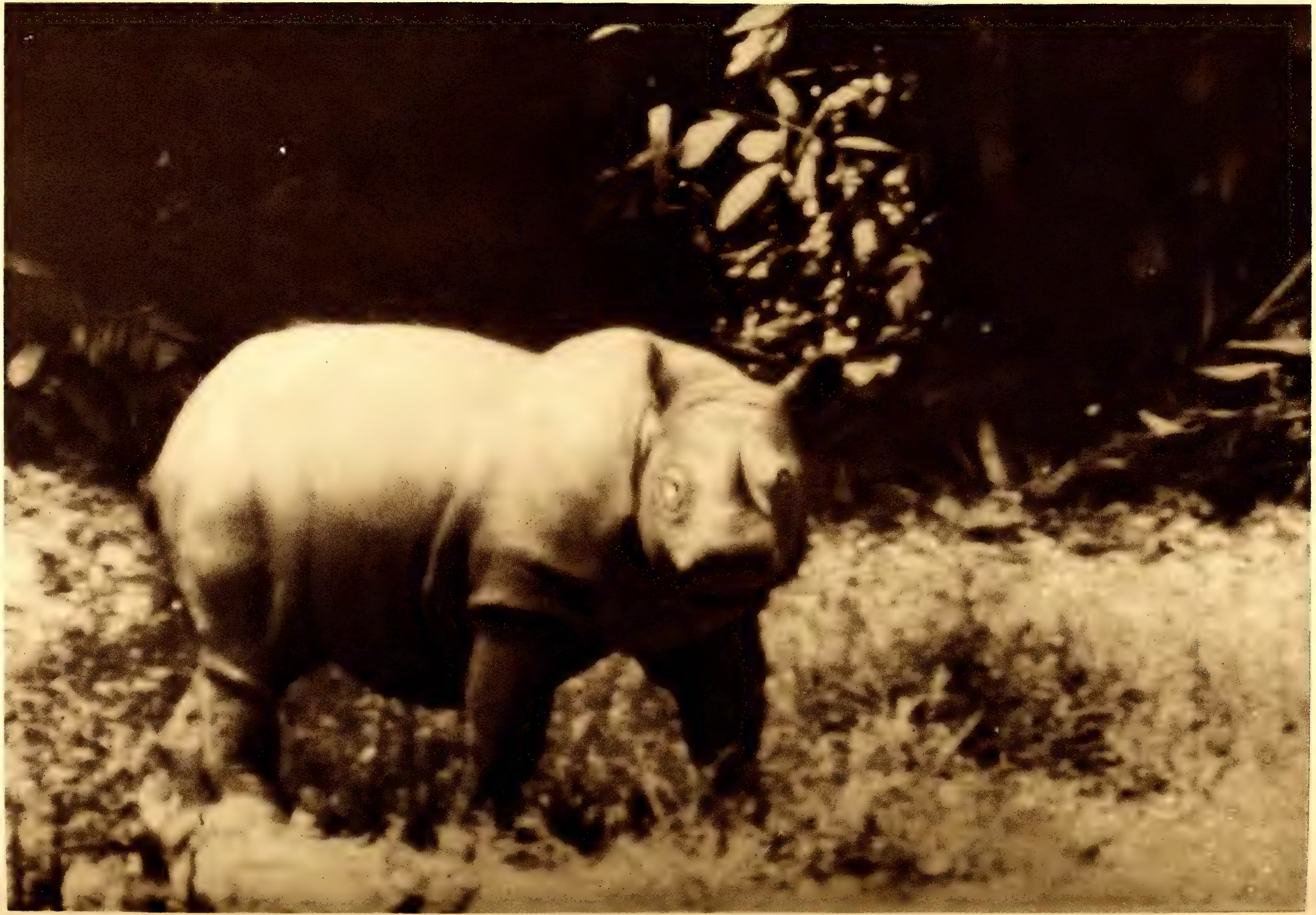
'Yes, there were very many when I was a boy. I remember a man, who devoted all his time catching rhinos in pits, coming here with a sack full of rhino's horns. I have not seen a rhino horn now for years, nor do I know where all the animals can have gone to.'

I had my answer.

That the number of rhinoceroses must have been large, if the old man's story is to be believed, is confirmed to some extent by the numerous trails made by them over the country we were talking about. A rhinoceros game path is different from that of an elephant —sometimes of course they use the same paths—being narrower, as the rhino's footprints continually overlap. Thus they wear a deep furrow down the middle of the path when the track is in steep country. I have seen a trail leading down to a wallow which was six to seven feet deep and much too narrow for an elephant to pass along. But the most astonishing trail I ever came across was in limestone country, where the 'sack full of rhino's horns' came from. Here there is a huge limestone massif, 2,000 feet high, which was often circled by rhinoceroses when travelling that way. In this case a trail passed between two large limestone boulders, both of which were well polished for a height of about three feet. These boulders rested on bed rock,—limestone—and in this bed rock the trail had been worn down a few inches! How many thousands, nay! tens of thousands, of rhino's feet must have passed along that trail?

None pass now, because there are none to pass.

As I have shown in an earlier part of this article, parts of the rhinoceros's body have been used since ancient times for magical rites or as medicine. This has been the main incentive to the hunting and killing of these animals in Asia so as to bring them to the point of extermination. Killing for profit, and large



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profits in the case of rhinoceroses, will always be fatal to rare species.

In Malaya the rhinoceros's horn is the chief attraction, Chinese being willing to pay as much as £2 (U.S. $10) or even more per ounce for the horn or part thereof. The dried blood is also a marketable commodity, fetching 5*sh.* (U.S. $1) a pound. It is collected and dried on paper, brown paper for preference—it weighs more—then dried over a fire, the resulting blood-soaked paper fetching the above price. But almost all parts of the body are considered valuable medicine of one sort or another, even the contents of the small intestines before they have been evacuated have a value to the medicine seller. The skin, roasted like pork cracknel, is considered a great delicacy. The horn is purchased by Chinese almost solely as an aphrodisiac. I cannot trace when this was first discovered but it is undoubtedly considered now as an infallible stimulant. Whether the effect of taking powdered rhinoceros horn in your tea or other vehicle is psychological or physiological it is difficult to determine, although it is quite possible that the powdered horn has some irritant effect on the generative glands and so produces a sense of virility which is normally not there. On the other hand, substitutes have been used as the following incidents show. Some years ago throughout Malaya imitation rhinoceros horns were hawked around the country by Chinese vendors who sold them to the Chinese medicine shops which are to be found in every small village. These imitations were good efforts to represent a rhinoceros's horn to anyone who had never seen the real thing, and went like hot cakes. The Chinese medicine shopkeepers knew, of course, that they were not rhinoceros's horns, but the ignorant Chinese labourer who felt the want of something to stimulate his desire, did not.

These imitations were made from buffalo horn and shaped like a rhino's horn.

There was one instance where one of these imitation horns was found in a Chinese medicine shop and displayed alongside a genuine rhinoceros's toe nail; just to show that there was no deception! These were seized by the Police who did not realize the difference between a real and a genuine horn. I saw the Chinese medicine man and asked him what he meant by having in his possession a rhinoceros's horn without a permit. The law requires one to have a permit. He immediately said that it was not a rhinoceros's horn at all. I explained that such was no news to me but he had apparently been selling shavings from this horn as rhinoceros horn and what was he going to do about it? That rather puzzled him. However I switched off on to the rhino's toe nail and he had a perfectly satisfactory explanation for that. However I warned him that he might still be prosecuted for cheating and the nail and horn would be held as exhibits.

Now, to finish this story I should have a string of satisfied or dissatisfied witnesses who testified to the efficiency or otherwise of the false horn. Unfortunately they were not forthcoming so the conclusion is incomplete. But the fact remains that this faked horn business was for some time quite a good line for the medicine shop-keepers, so possibly the superstition may be founded and supported on psychology only.

Malays attach all sorts of qualities to the rhinoceroses' horns which are merely childish. One is that a deep seated thorn can be extracted by rubbing the sore part with a rhinoceros's horn; another is that a severe stomach ache or any other ache can be relieved immediately by the application of a rhino's horn to the affected part, and so on. They are never willing to substantiate their claims by a demonstration—the horn is never forthcoming.

Still, these legends persist and so long as they persist and so long as there is no serious attempt to tackle the problem of how to preserve the rhinoceros for posterity, the *Dicerorhinus sumatrensis* is doomed.

In Malaya the *Rhinoceros sondaicus* is on the verge of complete extinction due to these superstitions and the failure of poor efforts to conserve it.

POSTERITY.

What will Posterity say of the present generation which is allowing, in many parts of the world, the fatal progress of the extermination of species, while professing an anxiety to save such species for future generations?

Unfortunately in the present state of our civilization those who have most to say are frequently those who know the least about their subject. Wild Life Conservation is no exception to this unfortunate state of affairs as all true conservationists will agree.

Dicerorhinus sumatrensis is on the threshold of a position that will inevitably cause it to disappear. I do not suggest that the last of its race will necessarily die a violent death but, due to disturbance and lack of proper facilities to enable them to exist under congenial and natural conditions, they will not breed.

The *sumatrensis* is, I believe, a long-lived species, and as such there will be for many years a solitary one or two left in remote places, which the opponents of proper conservation, and there are many of them, will point to as evidence of the adequateness of the futile arangements, mostly on paper, that have been made for their salvation.

In the new Wild Life Protection Act, 1936, Burma, which might be considered as the last word on Wild Life Protection, the killing, taking, importation or exportation of rhinoceroses or any part thereof, is prohibited, although there is a provision to enable the Local Government to give special licences to do some of these acts for scientific purposes.

This sounds as if the rhinoceros was very well protected but unfortunately a proviso has been inserted in the Act which reads as follows:—

> 'Provided that it shall not be an offence for any physician or druggist to possess or sell or for any person to possess for private medical purposes rhinoceros blood or any preparation thereof: . . .'

How anyone can become possessed of any part of a rhinoceros when all killing and hunting of that animal is prohibited, when all import of the animal or any part thereof is prohibited, and still keep within the law, seems problematic. Why therefore insert a clause which seems to provide a very large loophole for illicit dealings in rhinoceroses' blood which means dead rhinoceroses?

Possibly the Local Government anticipates the giving of licences to such persons as those mentioned above to possess 'for scientific purposes', and if so the trade in these objects will not be stopped.

Possibly the difficulty will be overcome by substituting buffalo's blood for rhinoceroses' blood and so placate Public Opinion which appears to have been responsible for the loophole in this Act.

But it does not help the preservation of rhinoceroses which are now far too rare to be dealt with in any other way than by complete and adequate protection.

To save them from complete extinction, the only hope that remains for the rhinoceros in Malaya, and I think I may add in Burma, is to constitute inviolable sanctuaries in their own habitat where a suitable environment is known to exist. These sanctuaries must be properly guarded and freed from human interference and severe penalties should be provided for any breaches of such laws as are enacted to make these places real refuges for the rhinoceroses in them.

There must be no loophole in the Act such as there is in the Burma Act. Whatever superstitions there may be connected with the rhinoceros, it must be recognized that these superstitions have brought all species of the Asiatic rhinoceros to the verge of complete disappearance, and, unless steps are taken to make it practically impossible to continue to commercialize these superstitions, then we must realize that we are impotent to save the *Dicerorhinus sumatrensis* from extinction.

ADDITIONAL NOTES ON THE ASIATIC TWO-HORNED RHINOCEROS.

BY

S. H. PRATER, C.M.Z.S.

SPECIES AND RACES OF THE ASIATIC TWO-HORNED RHINOCEROS.

The Asiatic Two-horned Rhinoceros was first made known in scientific literature by Bell (*Phil. Trans.*, p. 3, t. 2, 1793) who described an animal killed in Sumatra under the name of the Double-horned Rhinoceros of Sumatra. It was on Bell's decription that Cuvier (*Règne An.* i, p. 240, 1817) founded the name *Rhinoceros sumatrensis.* Three years later Raffles (*Trans. Linn. Soc.*, vol. xiii, p. 208, 1820) described the same animal under the name *Rhinoceros sumatranus.* Raffles' name is however antedated by Cuvier's. Later, as skulls, horns, skeletons and even live examples of this rhinoceros became available in England and the Continent, attempts were made by naturalists to distinguish various species of Asiatic Two-horned Rhinoceros from the different areas of its wide range.

Thus in addition to the species originally described by Bell, four other species of Asiatic Two-horned Rhinoceros were distinguished. *R. crossii* was established by Gray (*P.Z.S.*, p. 250, 1854) on a single horn of unknown origin presented to the British Museum by Mr. Cross in 1854. *Ceratorhinus niger* was the name given by Gray (*Ann. Mag. Nat. Hist.*, ser. 4, vol. xi, p. 359, 1873) to a Malaccan Rhinoceros acquired by the Zoological Society of London in 1872. Gray distinguished it from the typical Sumatran animal, (as described by Bell), by its broader skull, wider lower jaw and black colouring. *C. blythii* was established by Gray (*Ann. Mag. Nat. Hist.*, ser. 4, vol. xi, 366, 1873) on three skulls of Two-horned Rhinoceroses from Tenasserim, figured by Blyth (*Journ. As. Soc. Bengal,* vol. xxxi, t. iii, figs. 1, 2, 3). It is difficult to discover from Gray's description which of the skulls served as his type, but he indicated that two skulls representing younger animals revealed certain differences in structure of the lower jaw sufficient for recognition as distinct species, to which he gave the name *blythii,* to differentiate them from his Malaccan species *niger.*

Rhinoceros lasiotis was established by Sclater (*P.Z.S.*, p. 493, pl. xxiii, 1872). His type was a young Two-horned Rhinoceros which was captured in Chittagong in 1869, and purchased by the Zoological Society of London in 1871. Anderson (*P.Z.S.*, p. 129, 1872) saw the animal at Calcutta and wrote an account of it under the name *R. sumatranus.* Sclater (*loc. cit.*) described and figured the animal, and in a foot note to his account assigned to it the name *lasiotis,* amplifying his reasons in a subsequent paper (*P.Z. S.*, p. 790, 1872). He was led to his conclusions by a comparison of the Chittagong animal with the Malaccan Rhinoceros, referred to above, which was acquired in the same year by the Society. He differentiated the Chittagong rhinoceros by its larger size, pale browner colouring, smoother skin, longer, finer and more rufescent hair, shorter, more tufted tail, and by the ears having a drooping fringe of hair, some 5 in. long, and above all by the much greater breadth of the head as indicated by the great width of the skull between the ears.

In the year 1876, Flower (*P.Z.S.*, p. 443, 1876) on examination of the considerable accretion of material by then available in the British Museum and in the Museum of the Royal College of Surgeons came to the conclusion that there were no more than three distinct types of Asiatic Rhinoceros :—the Great One-horned Rhinoceros (*R. unicornis*), the Lesser One-horned Rhinoceros (*R. sondaicus*), and the Asiatic Two-horned Rhinoceros (*R. sumatrensis*). As to the existence of more than one species of Asiatic Two-horned Rhinoceros he remarked that the distinctive characters indicated in the skull of the Malaccan Rhinoceros, which provided the type of Gray's *niger*, were individual characters due to age. The animal was an old female. He was unable to examine the skulls which formed the type of Gray's *blythii*. These were in the Indian Museum. As regards *lasiotis* of Sclater, he had the opportunity in the following year of examining the skull of a rhinoceros killed at Comillah in Tipperah, i.e. from the province from which the type of *lasiotis* originated. He could find in the skull no characters which would justify its recognition as a separate species (*P.Z.S.*, p. 636, 1878). He showed that the skulls of Two-horned Rhinoceros present considerable individual variation in general conformation: proportionate breadth to length, the development of the nasal bones, number and position of lachrymal foramina, and other details. Blyth (*J.A.S.B.*, vol. xxxi, p. 862, 1861) from an examination of an extensive series of skulls, had previously indicated the considerable individual variations exhibited in the skulls of all three species of Asiatic Rhinoceros. He showed that skulls of *unicornis, sondaicus* and *sumatrensis* all exhibited a short and broad type with a high occiput and considerable width between the orbits and a second type which exhibited exactly the opposite characters, while other skulls showed an intergradation between these extremes. A similar variation is seen in the skulls of the Indian Wild Boar (*Sus cristatus*). The variation occurs in both sexes, and is not confined to particular areas of distribution. As regards the external characters by which the various species were distinguished, these again were shown to be individual in nature.

Subsequent authors have regarded the various so-called species of the Two-horned Rhinoceros as forms of the typical race *sumatrensis*. The famous Rhinoceros from Chittagong which provided the type of Sclater's *lasiotis* died in the Zoological Gardens in 1901. Oldfield Thomas (*P.Z.S.*, p. 154, 1901) who examined the specimen indicated that none of the external characters relative to colour, development of hair, etc., which were so distinctive in the animal when it was young, remained at the time of its death. They had disappeared with advancing age. Even the lengthy hair fringes, which formed so distinctive an adornment to the ears of the animal, were at the time of its death reduced to the short bristles customary in adults. Anderson (*loc. cit.*) had commented upon this particular character when he first saw the animal at Calcutta, and attributed the great development of its ear fringes to its age. He remarked that lengthy ear fringes were not in evidence in adult male and female Two-horned Rhinoceroses which he had seen in Burma. Nor did Thomas discover in the skull of Sclater's *lasiotis* any tangible character by which it could be distinguished from the typical *sumatrensis*. None except size. Of the 12 skulls examined by Thomas, the skull from Chittagong was easily the largest. The skull measurements recorded by him are 23 5/8 in. in a straight line from the occipital crest to the end of the nasal; zygomatic breadth 12 7/8 in.; interorbital breadth 8 in. A skull in the British Museum, presented by Sir Stanford Raffles, which is believed to have come from Sumatra, approached the Chittagong skull in measurements. Thomas indicated that if the locality was correct, the existence of an equally large form in Sumatra would dispose of the last claim of *lasiotis* to distinction as a separate race. He however doubted the correctness of the locality and therefore provisionally retained *lasiotis* as a northern form or race of the Two-horned Rhinoceros, distinguishable alone by its greater size. The Two-horned Rhinoceros is probably now extinct in Bengal, and whether animals from this province were in fact consistently larger than those inhabiting Sumatra can probably no longer be ascertained. Measurements of skulls available in the British Museum, indicate that skulls from Sumatra, Borneo and Malacca are smaller than the skulls from Bengal. While skulls from Pegu and Arracan are intermediate. Size is then the only character by which this supposed northern race is distinguishable.

Lydekker (*Cat. Ung. Mam., B.M.*, vol. v, p. 50), in addition to *lasiotis* from Bengal, recognises *blythii* as a distinct race occurring in the Malay Peninsula and Tenasserim. He differentiates *blythii* from typical *sumatrensis* as a smaller, blacker, less hairy form. There is no evidence to indicate that the Two-horned Rhinoceros inhabiting Tenasserim are smaller than those from Malacca or Sumatra. The colour of the body and hairiness are, as has been indicated, individual characters. Wroughton in his 'Summary of the Results of the Mammal Survey' (*J.B.N.H.S.*, vol. xxvii, p. 311, 1921) dismisses the race *blythii* and recognises only the northern form *lasiotis*, limiting its distribution to Eastern Bengal. He gives the distribution of the typical race *sumatrensis* as Pegu, the Malay Peninsula, Sumatra and Borneo.

THE ASIATIC TWO-HORNED RHINOCEROS AS A DISTINCT GENUS.

The question has also been raised as to whether the various species of Rhinoceroses now included under the single Linnaean genus *Rhinoceros* are not really separable into different genera. Between the year 1738 when Linnaeus made the Great Indian One-horned Rhinoceros the type of his genus *Rhinoceros* and the year 1904, when Palmer published his great work, *Index Genera Mammalium*—no less than 42 generic names were proposed for the various kinds of Rhinoceros, many receiving generic names which were synonyms of one another. The earliest attempt to distribute the Rhinoceros into different genera was made by Gloger (*Naturg,* p. 125, 1841) who among other genera established a separate genus *Dicerorhinus* for the Asiatic Two-horned Rhinoceros. He was followed by Gray (*P.Z.S.,* p. 1003, 1867) who revised the classification of the *Rhinocerotidae,* and assigned the Asiatic Two-horned species to a separate genus *Ceratorhinus*, distinguishing it from the genus *Rhinoceros*, by the presence of two horns, by the well developed lumbar neck folds and by certain characters of the skull.

Flower (*P.Z.S.*, p. 44, 1876) supported Gray's classification and indicated certain distinctive characters in the skull of the Asiatic Two-horned Rhinoceros. In this species the long downward processes of the squamosal bone, called respectively the post glenoid and the post tympanic, do not unite below the auditory meatus, whereas fusion of these processes is exhibited both in the Great Indian One-horned Rhinoceros (*R. unicornis*) and in the Lesser One-horned Rhinoceros (*R. sondaicus*). Apart from distinctions in the skeletal structure of the Two-horned Rhinoceros, studies of the visceral anatomy of *R. unicornis* by Professor Owen (*Trans. Zool. Soc. London.*, vol. vi, p. 31), of *sondaicus* by Sir E. Horne (*Phil. Soc. Trans.*, 1821), of *sumatrensis* by Garrod (*P.Z.S.*, p. 707, 1877), also indicate considerable structural differences in the anatomy of the small intestine. In *R. unicornis* the gut is provided with numerous long cylindrical narrow outgrowths 'like tags of worsted', in *sondaicus* these tags are present, but are flatter and broader; while in the Two-horned Rhinoceros these tags are absent. Further, both *unicornis* and *sondaicus* have so called 'foot glands' embedded in the integument of the foot, in *sumatrensis* these glands are absent.

Apart from distinctions in the anatomy of these animals, palaeontological evidence of their distinctive origin and character has been provided by Professor Fairfield Osborn in his paper on the Phylogeny of the Rhinoceros of Europe (*Bull. Amer. Mus. Nat. Hist.*, xiii, p. 229, 1900).

In his paper Osborn recognises 6 distinct groups or sub-families of Rhinoceros, each forming distinct branches of the great Rhinoceros family. Discoveries subsequent to the publication of his paper which include the *Baluchitherium*, a gigantic hornless extinct form of Rhinoceros, whose fossil remains were first unearthed at Chur Lando, Baluchistan, in the year 1911, have led Prof. Osborn to add to the number of known groups. He now indicates 8 groups or lines of descent. All the herbivorous quadrupeds tend to spread and migrate into different habitats and climates and into new feeding grounds to which they become adapted through a principle, which Osborn calls *adaptive radiation.* According to Osborn, the 8 lines of Rhinoceros separated from each other at a very ancient period and, although externally similar in certain cases, they are very far apart in their history and anatomy. The Great One-horned Indian Rhinoceros (*R. unicornis*) and its relative the Smaller One-horned Rhinoceros (*R. sondaicus*) have an obscure geological history. No representatives of this group of Rhinoceros have been found anywhere but in South Eastern Asia. Their remains are not found in the more ancient Siwalik beds but they appear with relative suddenness in the uppermost and more recent beds in the form of two species—the Siwalik Rhinoceros (*R. sivalensis*) and the ancient Rhinoceros of India (*R. palaeindicus*). The Two-horned Rhinoceros had a much wider distribution. No fossil species allied to the Sumatran Rhinoceros has ever been obtained from the Tertiary deposits of India. In Tertiary times however a number of species allied to the Sumatran Rhinoceros inhabited the forests of Central and Western Europe. Their remains are abundant in the Miocene and Lower Pliocene deposits of France and Germany. From which it is concluded that the Two-horned Rhinoceros is a comparatively recent immigrant into Southern Asia, the type having probably originated in Western Europe. The earliest representative of the group in Southern Asia is the flat-nosed *Rhinoceros platyrhinus* of the Lower Pleistocene beds of India. They were quite abundant in the Siwalik Hills in the late Pliocene or early Pleistocene times. The Upper Pliocene is indicated as a geological period when these animals, favoured by a genial climate lived in a broad forest belt which extended from the East Coast of England and southwards and eastwards across southern France and northern Italy into India. Like their descendants of today, the primitive two-horned forms probably lived in the deepest recesses of the forest. The survival of the type through long epochs of time is traced to the protected environment in which they habitually lived—an enviornment which, while it does not favour rapid evolution, tends on the other hand to persistence of type.

From all this it will be seen that the various species of Rhinoceros though externally similar are very far apart in their history and anatomy. The question arises as to whether these distinctions entitle them to be grouped in separate genera or whether they merely represent natural divisions of the Linnaean genus *Rhinoceros*, to which most naturalists have hitherto assigned them. Oldfield Thomas (*P.Z.S.*, p. 112, 1901) indicated that if there is to be any uniformity in the value of genera as recognised among Mammals, it is impossible to include such essentially different animals in one genus *Rhinoceros*. He considered that the generic groups as proposed by Osborn (*loc. cit.*) should be accepted. He however indicated that the name *Ceratorhinus* Gray (*P.Z.S.*, p. 1021, 1867) used by Osborn for the Asiatic Two-horned Rhinoceros was antedated by Gloger's name *Dicerorhinus* (*Naturg.*, p. 125, 1841) which therefore by technical priority is the correct generic name.

SUPPLEMENTARY NOTES ON THE ASIATIC TWO-HORNED RHINOCEROS.

Measurements.

Young. The measurements of a newly born *R. sumatrensis* which was born on the Steamship *Orchis* in Victoria Docks, London, on December 7th, 1872, have been recorded by Bartlett (*P.Z.S.*, p. 104, 1873): length 3 ft., height at shoulder 2 ft., weight estimated at about 50 lbs. Bartlett remarks that with its long legs, long head and meagre body, and in its movements it was rather like a young ass.

Adult. The young female Rhinoceros from Chittagong to which reference has been made at the time of its arrival in the Zoo (1872) measured 4 ft. 4 in. at the shoulder. The aged female from Malacca which was a contemporary at the Zoo of the Chittagong animal, was according to Bartlett 3 ft. 8 in. high at the shoulder. Evans (*Journ. B.N.H.S.*, vol. xvi, p. 161 and 455) records the measurements of a male and a female from Burma :

	Length *Muzzle to root of tail*	*Girth* *behind shoulder*	*Height* *at shoulder*	
♂	8′ 2″	7′ 2″	4′ 4½″	(measured between uprights.)
♀	7′ 9″	6′ 6″	4′ 6″	

Colour and Development of Hair.

Newly Born. Bartlett (*P.Z.S.* 1872, p. 104) describes the colour of the newly born rhinoceros referred to above as being nearly black, covered with short crisp black hairs; the ears very hairy inside as well as outside. (His illustration shows the margins of the ears heavily fringed with hair). Tail quite like a brush at the tip.

Young. The rhinoceros captured at Chittagong in February 1869 and subsequently acquired for the London Zoo, was described by Anderson who saw it at Calcutta in 1870. He describes it as a young female. It died in London in 1901, 32 years after its capture. The general colour of the skin, according to Anderson *P.Z.S.*, p. 129, 1872), was ashy grey becoming light brown when moist, the arm pits and under surface of the groin and the skin within the creases formed by the folds of the body had a flesh pink tint. The face, anterior to the eyes, was nude of hair except for the pendulous lip which had strong bristles set wide apart. The outer margins of the ears were heavily fringed with drooping hairs nearly 5 in. long and the insides were covered with short bristles. The body was covered with bristles about 1 in. in length; on the head and neck they were shorter and on the sides of the belly and over the wrists and heels, the hairs were adpressed and somewhat curly; the upper two-third of the tail was covered with bristles. The hairs on the margins of the lower third of the tail, increased in length towards the tip, the apical hairs being about 6 in. long.

The colour of the body hairs varied; on the head and neck the bristles were almost white, on the upper half of the trunk, the bristles anterior to the shoulder fold were dark brown, posterior to the shoulder fold, they were almost white in some lights and showed a rufous tint in others. On the lower half of the trunk they were black. The rufescent tint of the body bristles is also remarked upon by Sclater, who says that it gave the animal a brownish appearance in certain lights. Anderson's description of the colour of the Chittagong rhinoceros coincides with Bell's original description of a male from Sumatra in which the general colour is described by him as brownish ash; under the belly and between the legs, and, within the folds of the skin—dirty flesh.

Old. The Rhinoceros from Malacca acquired by the London Zoo, an aged female, is described as being black. Garrod who described the anatomy of the animal, refers to the colour as dark slaty. The hairs covering the body were shorter, coarser and more bristly than in the young animal from Chittagong in which the hair is described as being softer tending to lie flatter on the skin. The body hairs were more sparse than in the young animal, and were most in evidence in the middle line of the back and on the outer sides of the limb. The tail, though covered with black straggling bristles, had no terminal tuft. The inside of the ears had a covering of short black hairs and the outer margins were similarly lined with short bristles. Anderson remarks that adult animals of both sexes seen by him in Burma, had the ears fringed with strong erect black hairs tipped with brown. He suggests that the delicate terminals of the hairy ear fringes are worn off as the animal increases in age, probably by the friction to which the ears are subjected in the creatures wanderings through the dense jungle. This explanation does not quite meet the case of the Chittagong Rhinoceros, which spent the greater part of its life in an open paddock, and nevertheless exhibited, when old, the same loss of its drooping ear fringes, which at the time of its death were reduced to short bristles.

Development of Horns.

The newly born rhinoceros described by Bartlett (*loc. cit.*) had a front horn on its nose about $\frac{3}{4}$ of an inch in length. The posterior horn was not developed, but a smooth, spot indicated its position. As regards the length of horns—the horn presented to the British Museum in 1854 by Mr. Cross, on which Gray established his species *R. crossi*, measured according to Gray (*P.Z.S.*, p. 250, 1854) $31\frac{1}{2}$ in. along the curve with a girth of $17\frac{1}{2}$ in. at the base. Probably this is the horn mentioned in Rowland Ward's *Records of Big Game*; though its present measurements are given as length $32\frac{1}{8}$ in., circumference $17\frac{3}{8}$ in. In his Memoir on Asiatic Rhinoceros, Blyth (*J.A.S.B.*, xxxi, p. 156, 1862) figures a splendid head then in the possession of Col. Fytche, Commissioner of Martaban and Tenasserim. This was an animal killed in Tavoy. The span of curvature from base to tip is 24 in. Col. Fytche informed him that he had in his possession a head with still finer horns, some 5 or 6 in. longer. In a letter to Blyth he speaks of a Rhinoceros which he tracked up a mountain 4000 ft. high; near the summit he came suddenly upon the beast whose anterior horn was at least 10 or 12 in. larger than the one he had got. Unfortunately, the gun bearer on seeing this giant fell down on his face in fright and rolled down the hill. Blyth's observations indicate that even so far back as 1862, fine horns of *R. sumatrensis* were extremely difficult to obtain and were bought up at high price by Chinamen, who not only valued them as medicine but carved them into wonderful ornaments. The comparatively poor development of horns in these animals at the present time is probably due to the persistent persecution and the killing off of better horned animals and the breeding of poorer stock. Similar deterioration is seen in the horns of Sambar and other deer in areas where they are subjected to constant harassment.

Development of Hoofs.

Bartlett (*P.Z.S.*, p. 106, 1873) records the condition of the hoofs in a newly born Rhinoceros. At birth the hoofs or nails are long and pointed; the points are soft and turn inwards so as to fold over and cover part of the sole of the foot. From the manner of their turning under it is evident that the turned in parts of the horny nails covering the sole are worn through by continuous contact with the ground, and the frontal portion is all that remains to provide the blunt nail.

Habits.

Mr. Hubback refers to the peculiar habits of the male when urinating, the urine being shot upwards and backwards between the legs for some distance so that leaves of the surrounding trees and bushes are sprinkled. He expresses doubt as to whether this habit is exhibited by the female also. Anderson who recorded his observations on the habits of the female rhinoceros, captured in Chittagong, writes: 'She has a peculiar habit of squirting out her urine to a great distance, sending it out behind her for nearly 20 feet, a habit by which the male is made aware of her presence in the dense recesses of his native forests where smell is probably the sole guide by which the sexes become aware of each other's presence'. It is evident from the above that both sexes share the habit. Major G. H. Evans' observation on the habits of *R. sumatrensis* in Burma (*Journ. B.N.H.S.*, vol. xvi, p. 555) agrees with Mr. Hubback's that this rhinoceros does not repeatedly visit the same spots for the deposition of its faeces. He writes : 'Small heaps or mounds, perhaps the droppings of a week may be found on the hill sides where they lie up. But as a general rule I do not think that they can be particular in this matter as one habitually finds single droppings on the tracks on the sides of hill ridges and an abundance of them scattered in the beds of streams.' The Great Indian One-horned Rhinoceros (*R. unicornis*) on the other hand is known to revisit particular places for the evacuation of excreta which accumulate in mounds. The habit facilitates the work of the poacher who lies in wait for the Rhinoceros in the neighbourhood of these spots; his task is simplified by the animal's habit of approaching the place backwards. Other animals, besides the great One-horned Rhinoceros, display this particular habit, notably the Indian Porcupine (*Hystrix leucura*) and the Four-horned Antelope. In the case of the porcupine enormous mounds of ordure, the product of one or more animals, are commonly found.

Food.

Further information regarding the plants and fruits eaten by *R. sumatrensis* has been given by G. H. Evans (*Journ.*

B.N.H.S., vol. xvi, p. 555) and by Mr. W. S. Thom (*Journ. B.N.H.S.*, vol. xxxviii, p. 137). In the matter of food, Evans does not differentiate between *R. sumatrensis* and the Lesser One-horned Rhinoceros (*R. sondaicus*). Both species appear to have the same feeding habits; neither feeds much on grass. Both subsist mainly on leaves, fruits and twigs. The conformity in feeding habits is evidenced in the similarity in structure of the molar teeth of both these animals. Their teeth differ materially in the form and in the pattern presented by wear from those of the Great Indian One-horned Rhinoceros, a species which is by habit a grazer, feeding almost exclusively on grass. The feeding habits of *R. sumatrensis* and *R. sondaicus* have profoundly influenced their distribution. Finding their subsistence on a great variety of forest trees and shrubs, these two species have extended their range through the great forest tracts reaching from the confines of Assam and Bengal, through Burma and the Malay Countries. The Great Indian One-horned Rhinoceros on the other hand is limited by the nature of its food to a range confined to the grass jungles of the North Indian alluvial plains. Similar factors have limited the range of the grass-eating White Rhinoceros, and facilitated the wider distribution of the 'browsing' Black Rhinoceros on the African Continent.

Beliefs and Legends.

Many beliefs and legends attach to the Rhinoceros and are generally applicable to all species. Writing of the Rhinoceros in Nepal, General Sir Kaiser Shumshere Jung Bahadur says 'The flesh and blood of the Rhinoceros are considered acceptable to the *Manes* to whom high caste Hindus and most Gurkhas offer libation of its blood after entering the disembowelled body'. Rhinoceros blood is efficacious to the dying as it is believed to ensure for the soul both a peaceful departure and a happy release on the other side. It should be mentioned that the power of ensuring peace for the departed soul is retained by the 'Shell' of the beast for years after its decease. Continuing, General Kaiser says 'The urine is considered antiseptic, and is hung in a vessel at the principal door as a charm against ghosts, evil spirits and diseases'. In the Calcutta Zoo there is always a brisk demand for this product of the Rhinoceros. The above beliefs are in no way confined to Nepal as the Chinese, Burmese, Siamese preserve practically every part of the Rhinoceros. The horns, blood, urine and hide and even the intestines are converted into medicine. The belief in the virtues of Rhinoceros Horn, persisted in Europe even to the end of the eighteenth century. So recently as 1763, it was asserted that a cup made of Rhinoceros horn would fall to pieces if poison were poured into it. 'When wine is poured into it', wrote Dr. Brookes, 'it will rise and ferment, but when mixed with poison it cleaves in two, which experiment has been seen by thousands of people'. The belief is probably of eastern origin where it was prevalent long before it grew current in the West. Apollonius, whose travels to India in the first century have been recorded by his biographer Philostratus, speaking of a cup of

Rhinoceros horn said: 'On the day they drink from the cup they cannot fall sick; nor suffer if wounded, nor be injured though they pass through fire; wherefore these cups belong to the king alone; nor might any other hunt this animal'. Asked by his friend Damidius whether he believed in this tale, the sage replied 'I believe it if I find the king of this country immortal. For if any one gave to me, or to another, such a health bearing cup, is it not likely that I should use it daily to drink it to the dregs? Nor could any one blame me for getting drunk under such circumstances.'

It has been indicated how the Rhinoceros inherited many of the vaunted virtues of the Unicorn. Among them, its weakness in the presence of virgins, and the efficacy of its horn against poison. The origin of the belief in the Unicorn is lost in the mists of antiquity. Various explanations have been given as to its origin and various animals have been suggested as its counterpart; among them the Oryx, the Wild Ass and the Rhinoceros. But a less usual explanation traces the origin of the Unicorn not to a four-footed beast, but to a reptile. None other than the Horned Viper, *Cerastes,* which bears above each eye a projecting scale, shaped somewhat like a horn. The origin of the belief in the Dragon is traced to the Python, which poetic fervour and imagination endowed with wings, limbs, claws; and in a similar way this common and dreaded horned viper, which figures prominently in Assyrian and Hebrew Religion and Art, took unto itself in legend and story the form of a powerful four-footed beast. If the horned *Cerastes* gave origin to the Unicorn, it is easy to understand the attributes legend gives to this fabled animal. To the poisonous nature of *Cerastes* is due the supposed efficacy of the horn of the Unicorn as a protection against poison. For the belief that poison counteracts poison goes back to the earliest times. Is there not current even today in India the ancient belief that the 'stones' or jewels supposed to be derived from the head of the cobra and other snakes are efficacious against their venoms? And the belief in the virgin's power over the Unicorn is perhaps traceable to the Woman's domination over the Serpent, of which mention is made in the Bible—these wondrous attributes passing subsequently from the Serpent to the Unicorn and from the fabled Unicorn to the Rhinoceros.

THE BIRDS OF BOMBAY AND SALSETTE.

BY

SALIM ALI AND HUMAYUN ABDULALI.

PART VI.

(*Continued from p. 381 of this Volume*).

The Indian Blue-breasted Banded Rail : *Hypotaenidia striata striata* (Horsf.).

Field identification: Slightly smaller than the Partridge. A stub-tailed, long-legged marsh bird skulking about singly among reeds, etc. on the edge of tanks or water-logged paddy cultivation. Dark brown and olive-brown above, with white markings, ashy-grey and brown below with the abdomen and undertail barred white. Chin and throat white; crown rufous. Twitches its stub-tail up and down at every step. Flushed with difficulty. Slow laboured flight with legs trailing behind.

Noted and/or shot: Gōrēgāon and Powāi Lake. Also at Kihim (Kolāba Dist.) across the Harbour, in a mangrove swamp.

Doubtless resident, though as yet we have no breeding records from our area.

The Spotted Crake: *Porzana porzana* (Linn.).

Field identification: Size between the Quail and the Partridge. Reddish olive-brown above with black streaks; grey below. Speckled with white on breast, neck and upper back. Lower back, rump and upper tail coverts streaked narrowly with white. Similar in general effect and habits to the foregoing species. Singly, in reed-beds, etc. on the margins of tanks. A confirmed skulker.

Specimens: *B.N.H.S.*: ♀ 23-12-08 Malabar Hill, Bombay (J. C. G. Bowen); [o? Novem. 1893 Panwēl, Kolāba Dist. (W. S. Millard)].

Noted: Powāi Lake.

Winter visitor. Latest date 12 April. We have come across it only rarely, but Inverarity (*J.B.N.H.S.*, ii, 45—1887) says it is common round Bombay. It may well have been commoner before the low-lying marshy areas on the outskirts of the city and in the suburbs were reclaimed.

The Little Crake: *Porzana parva* (Scopoli).

Specimens: *B.N.H.S.*: o? Malabār Hill, Bombay (A. H. A. Simcox).

We have not seen this specimen, but it is listed in the old Card Catalogue of the Society's Collection prepared by Mr. N. B. Kinnear. It may have been an aberrant cold weather straggler. We have not come across it in Salsette.

The Eastern Baillon's Crake: *Porzana pusilla pusilla* (Pall.).

Field identification: Size about that of the Quail. General effect and colouration as of the Spotted Crake but lacking the white speckles on neck, breast and back. Breast grey, belly barred black and white. White edge to first primary quill conspicuous and diagnostic. Singly, in marshy reed-beds. Same skulking habits.

No specimens. Noted at Powāi, Tūlsi and Vihār Lakes, Vilé Parlé.

Status? Common, at least in the cold weather. A great skulker, flushed only when almost trod upon, flying quail-like for a few yards before dropping into the reeds again.

So far we have no evidence of its breeding in our area.

The Ruddy Crake: *Amaurornis fuscus fuscus* (Linn.).

Field identification: Like the Waterhen in general effect but somewhat smaller and predominantly chestnut and olive-brown with no white in face or breast. The bright red legs are conspicuous even in flight. Singly, among reeds and thickets of rank vegetation about marshy ground and paddy-fields.

Specimen: *St. X. C.*: 266 ♂ 21-11-36 Powāi Lake (H. A.)

Resident (presumably). Rare. We cannot trace any records of its breeding within our limits.

The White-breasted Waterhen: *Amaurornis phoenicurus chinensis* (Boddaert).

Local name: *Kuku-komri.*

Field identification: Size about that of the Partridge. Upper parts slaty-grey with olive tinge. Face, neck and breast white. Abdomen and under tail rusty red. Long yellowish-green legs with long toes. The stub tail is held cocked up and is constantly flicked. Singly or pairs, in and about reeds and thickets by marshes and water-logged fields. Often seen on roads near tanks and lakes.

Specimens: *B.N.H.S.*: ♂ July '24 Kūrla; 3 downy chicks 10-9-24 Kūrla (near Mohili River—D. A. Baretto).

Resident. Common. Silent except during the monsoon when it breeds and is very noisy. The calls begin with loud raucous grunts, croaks and chuckles suggestive of a much larger animal (EHA compares it to 'a bear being roasted over a slow fire'!), and settle down to a monotonous metallic *ku-wak ku-wak ku-wak*, etc. somewhat like that of the Coppersmith but in a higher key and repeated more quickly. This is often kept up for over 15 minutes at a stretch on cloudy overcast days. The calling continues more or less throughout the night. The food consists of insects, molluscs, seeds and vetgetable matter.

Breeding: Barnes (*J.B.N.H.S.*, vi, 39) found it breeding at Vihār Lake in August. In Salsette we have observed nests at Sion, Kūrla, Vilé Parlé, Andhēri, Pāli Hill (Bandra) and Trombay in August and September, though it probably begins laying in July. The nest is placed in the interior of a hedge or small tree—up to about 15 ft. from the ground—on the margin of a pond, tank or water-logged paddy field. Sometimes it is well hidden by monsoon creepers, at other times fairly open and conspicuous. It is a shallow cup-shaped structure something like a crow's nest, composed of twigs, grass and flags of reeds and bulrushes. In days gone by, EHA found a nest at Girgaum built in the top of a date palm. There used to be some marshy land there devoted to paddy cultivation. We have taken a grass-lined nest built on the ground near water at Powāi with c/6. The normal clutch consists of 4 or 5 eggs. They are some shade of buff with longitudinal blotches of reddish-brown and pale purplish-grey. The birds (both sexes?) are close sitters and may sometimes be almost caught with the hand when brooding. The young are able to run as soon as hatched and follow the mother about. They look very like domestic chickens and are covered with uniform black down. Their bill and legs are blackish.

The Indian Moorhen: *Gallinula chloropus indicus* Blyth.

Mahrātti name: *Likeer.*

Field identification: Size about that of the Partridge. General effect of a waterhen on land, of a small duck on water. Slaty-grey and brown with white border to wing and white undertail. Singly or gregariously, among partially submerged rushes, etc. often swimming out into open water with floating vegetation. It swims well with a characteristic jerky motion of the head and stub tail.

Specimen: *B.N.H.S.*: ♀ 7-3-21 Thāna (B. C. Ellison).

Noted: Vilé Parlé, Santa Cruz, Powāi Lake.

Resident. Fairly common on Powāi Lake and in smaller numbers at most ponds and village tanks with floating or marginal vegetation. No breeding record for our area.

The Kora or **Water-cock**: *Gallicrex cinerea* (Gmelin).

Field identification: Rather larger than the Partridge. Male in breeding plumage: Head, neck and lower parts chiefly black; above blackish-brown and slaty-grey. Covering the forehead and sticking up as a sort of casque or horn above the crown is a horny, red shield which is the most characteristic feature of the male watercock at this season. At other seasons the male is coloured like the female, brown and buff with wavy brown lines on the underparts. Singly, skulking amongst reedy marshes, Specimens: *B.N.H.S.*: o? June 1895 'Bombay' (A. Francke); *St. X. C.*: 265 ♀ 21-11-36 Powāi Lake (H. A.).

Noted by us in Salsette only at Powāi Lake.

Resident. Not common. Shy. We have no records of nests in our area; but a male shot by H. A. at Powāi Lake on 16 July (1933) was evidently breeding. Its testes measured 21×13 mm.

The Indian Purple Moorhen: *Porphyrio poliocephalus poliocephalus* (Lath.).

Field identification: A leggy bird the size of our domestic hen with long red legs, heavy red bill and a red horny shield covering the forehead. General effect of plumage purplish-blue. In swampy reeds and rushes on tank margins, etc., singly or gregariously.

Specimens: *B.N.H.S.*: o? 12-4-26 Kūrla (D. A. Baretto); [♀ 20-7-11 Panwēl, Kolāba Dist. (Mamlatdar, Penn.)].

Noted: Vihār and Powāi Lakes. In about 1887 Inverarity (*J.B.N.H.S.*, ii, 45) found large noumbers on Bhiwandi tank on the adjacent mainland (beyond Thāna).

Resident, in small numbers. Navarro has taken nests with eggs at Talegaon in September along with Waterhens and birds of this kind, much persecuted by local gunners who consider it good eating.

The Coot: *Fulica atra* Linn.

Local name: *Poonār; Kām.*

Field identification: A slaty-black duck-like bird with ivory-white pointed bill and a white horny shield covering forehead. Gregariously—loose flocks—on tanks, swimming about like duck and pattering along the surface of the water when alarmed and trying to take wing.

Specimens: *B.N.H.S.*: ♀ 16-11-25 Kūrla (D. A. Baretto); [♀ 2-12-12 Bassein (R. dos Remedios)]; ♂ 6-12-18 Kolāba Cove, Bombay Harbour (J. A. D. MacBain).

Noted: Powāi and Vihār Lakes. Mahaluxmi (1938). This is one of the birds that is being shot out of the Bombay District by enthusiastic 'sportsmen'. It used to be not uncommon on every small village tank in Salsette about 25 years ago when S. A. shot it frequently at Santa Cruz, Vilé Parlé and Andhēri, but is now rarely seen. Inverarity (*J.B.N.H.S.*, ii, 45—1887) always found it on Vihār Lake and other tanks during the cold weather. EHA (*C.B.B.*, 176) also writes of it as very common everywhere in the neighbourhood of Bombay. In some years it is not uncommon on Powāi Lake even now.

Status? Mainly at least a winter visitor. We have only come across it here during the cold weather months. Strangely enough this bird, which often covers enormous distances on migration, can be caught by hand on a small tank. The procedure is to surround it and keep it on the move with stones, shouts, etc. After a while it usually sneaks into cover on land, whence it is easily beaten out and captured. There is a common belief that a coot cannot fly when its wings dry up!

Breeding: Not recorded in Salsette, but Major R. M. Betham (*J.B.N.H.S.*, xiv, 176) found several nests near Poona between 14 July and 17 August 1901.

The Bronze-winged Jacana: *Metopidius indicus* (Latham).

Field identification: Size about that of the Partridge. A leggy bird with shiny greenish-bronze wings, chestnut lower back, rump and stub-tail. Head and lower plumage glistening black. A conspicuous white stripe from eye to nape. Young birds are very different being chiefly whitish, rufous and brown. The most characteristic feature of the Jacanas—this and the next species—is their enormously elongated and slender toes which enable them to trip along gingerly over lotus leaves and other floating vegetation. Singly or gregariously, on ponds and tanks with waterlilies, Singāra (*Trapa bispinosa*) and other aquatic vegetation.

Specimens: *B.N.H.S.*: ♂ imm., ♂ imm. 7-3-21 Thāna (B. C. Ellison); [♂ 7-12-09 Daman Road, Bombay (R. L. Sinclair)]; *St. X. C.*: 90 ♂—Powāi (H. A.).

Noted: Powāi and Tūlsi Lakes.

Resident. Fairly common.

Breeding: The nesting season is in the rains—July and August. The nests are partly submerged pads of rush-stems and weeds placed on floating vegetation on tanks and ponds. The normal clutch is of 4 eggs. In colour these are buff or olive intricately pencilled with fine black lines. We have taken numerous nests at Powāi. H. Bulkley found two nests at Thāna H. Wenden (*N. & E.*, iii, 357) found it breeding freely at Kalyan, 32 miles from Bombay, in August.

The Pheasant-tailed Jacana: *Hydrophasianus chirurgus* (Scop.).

Field identification: Size about that of the Partridge. A striking chocolate-brown bird with white head, foreneck, throat and wings. Golden-yellow hind-neck. The long, pointed blackish sickle-shaped tail gives it its name. In non-breeding plumage the colour is chiefly pale brown and white ; a black line runs through the eye down the side of neck and expands into a necklace on upper breast ; the pheasant-tail is missing. In non-breeding season—gregarious, often in large flocks—on waterlily- and Singara-covered tanks. H. A. has observed one in Bandra Creek, and Sinclair (*J.B.N.H.S.*, i, 164) one on a rock on the seashore in Konkan !

Specimens: *B.N.H.S.*: o? 20-5-28 Malād (E. Henricks).

Noted: Bandra, Andhēri; Powai, Tūlsi and Vihār Lakes.

Resident. Common. It has a peculiar nasal mewing call ***tewn, tewn,*** etc. commonly uttered in flight.

Breeding: The nest is a pad of rushes, etc. as of the Bronze-winged Jacana, placed on floating vegetation. We have seen eggs laid directly upon lotus and Singāra (*Trapa*) leaves in a seemingly precarious situation. The eggs are peg-top shaped, usually olive-brown in colour, and match to perfection the decaying sodden leaves on which they rest. Brother Navarro found 2 nests with c/3 and c/4 on the lotus-covered tank near Bandra railway station on 18 September 1937. One of the owners took alarm at the thermometer fixed to determine the temperature of the sodden nest and next morning the eggs were found on another lotus leaf 5 feet away. On the thermometer being shifted to this site the eggs were found to have been removed to a newer position about 2 feet away on the following day. How are the eggs moved?

The Painted Snipe: *Rostratula benghalensis benghalensis* (Linn.).

Field identification: Slightly larger than the Quail. A leggy typical rail. Above chiefly metallic olive-green with buff and blackish streaks and markings; lower plumage chiefly brown and white. A long slender snipe-like bill. The female is more showily coloured than the male. As with the Bustard Quail, she does all the courting and leaves the male to incubate the eggs and rear the young. Flushed singly or in wisps in swampy reed-beds and salt marshes by our creeks. Feeble, laboured flight, legs trailing behind.

Specimens: *B.N.H.S.*: ♀ 7-3-21 Thāna (B. C. Ellison), ♂ Decr. 1893, ♀ Decr. 1890 Bombay (E. L. Barton), ♀ 7-12-24 Kūrla (D. A. Baretto) juv. 29-10-14 Thāna (Counsel), juv. (in down) 15-10-24 Kūrla (S. A.) o? 8-12-25 Vilé Parlé (S. A.); *St. X. C.*: 101 ♀, 102 ♂ 3-10-33 Andhēri (H. A.).

Noted: Powāi and Tūlsi Lakes, Gōdhbunder, Mulund.

Resident. Common. Stomachs of specimens examined by us contained remains of snails and orthopterous insects, and paddy grains.

E. Henricks, the Society's skinner, reported to us in June 1930 that he had caught at Malād an adult specimen which was unable to fly well due to some heavy weight attached to one of its feet. Examination showed a large Ampullaria shell adhering firmly to the middle toe of one foot. The operculum had closed when accidentally trod upon by the bird.

Breeding: It is not unlikely that the Painted Snipe breeds in Salsette throughout the year. We have not actually found any nests here but have taken ovarian eggs from a female shot on 12 April. The gonads of specimens were in breeding condition from the end of September to early May and we also found young in all stages during these months. *Stray Feathers* (vii, 526) records that on 1 December 1878 J. D. Inverarity caught two half-grown chicks, unable to fly, at Gōdhbunder. The nest is a pad of grass or rushes with a slight depression in the centre in which normally 3 or 4 eggs are laid. They are some shade of yellowish-stone colour, blotched and streaked with brown. The nest is usually placed on the ground in grass on the edge of a marsh, on bunds, etc.

The Indian Sarus Crane: *Antigone antigone antigone* (Linn.).

Field identification: A large grey stork-like bird with long bare red legs and naked red head and neck. Usually pairs, stalking about cultivation and marsh land.

Aberrant straggler. Owing to the severe drought in Gujerat and the Deccan, several of these birds were seen in and near Bombay during the cold weather of 1900. H. S. Symons (*J.B.N.H.S.*, xix, 261) records seeing a solitary bird at Santa Cruz on 9-12-08. A few days previous to this he had seen a dead Sarus near Bandra railway station and conjectures that this may be the other of the pair. He mentions that once before he had seen this species at Panwēl (Kolāba Dist.) in 1897 which was also a famine year upcountry. We have no more recent records from Salsette.

The Sarus is common in Gujerat where it is clothed in sanctity and protected by the inhabitants.

The Demoiselle Crane: *Anthropoides virgo* (Linn.).

Aberrant straggler. Following the severe drought in Gujerat and the Deccan, several birds were seen in Bombay during the cold weather of 1900. Not recorded since.

The Lesser Florican or Likh: *Sypheotides indica* (Miller).

Field identification: Slightly larger than the Red-wattled Lapwing and somewhat similar to it in general effect. Male black and white with curious black ear-plumes sticking out behind head. Female brown above finely stippled and pencilled with black; buffy-white below. In stretches of tall grassland.

Specimen: *B.N.H.S.*: ♂ imm.—Bombay (N. C. Macleod).

Rare straggler? Kinnear calls it 'an uncommon cold weather visitor', but as will be seen, the records are not confined to that season. Single birds have been observed from time to time, the records for our area and the adjacent mainland being as follows:

Bombay and Salsette:

Mahaluxmi, ca. 1889 (H. S. Symons, *J.B.N.H.S.*, xix, 261).

Between Andhēri and Malād, December 1912 (M. F. Suter, *ibid.*, xxii, 631).

♀ Catholic Gymkhana Grounds, Kennedy Sea Face 4-9-18 (N. Marryat, *ibid.*, xxvi, 674).

Near Churchgate Railway Station, 8-6-13 (*Times of India* of 10-6-13).

Mainland:

Panwēl 17-1-09 (H. S. Symons, *J.B.N.H.S.*, xix, 261).

♀ Between Māndwa and Alibāg, 16-12-12 (C. D. Baker, *ibid.*, xxii, 202).

♀ Karjat (foot of Bhōr Ghat) 20-1-35 (J. Stokoe, *ibid.*, xxxviii, 191).

♀ Chinchavli near Neral, Nov. 1908 (M. F. Suter, *ibid.*, xxii, 631).

Kalyan, December 1912 (H. A. W. Brent, *Times of India* of 11-6-13).

H. A. saw a single bird near Chōndi (Alibāg Taluka) on 30-5-38.

[The Great Stone Plover: *Esacus recurvirostris* (Cuvier).

Field identification: Size about that of the domestic hen with long bare yellowish-green legs. Pale greyish-sandy above, white below. Some black in wings and a conspicuous black streak through eye. Largish head, thick, pointed somewhat upturned bill and round greenish-yellow goggle eyes. Singly or pairs, near rivers and tanks.

Specimen: *B.N.H.S.*: ♀ 22-11-21 Panwēl, Kolāba Dist. (E. L. Barton).

Status? Rare. We have only come across a solitary example on the mangrove marsh bordering Dharamtar Creek, near Rewās Pier (12-3-30). J. D. Inverarity (*J.B.N.H.S.*, ii, 45, 1887) shot a specimen at Panwēl, this being the only occasion on which he saw one. Not recorded in Salsette.]

The Indian Stone Plover: *Burhinus oedicnemus* ssp.

Field identification: Size slightly larger than the Partridge, and much more leggy. Singly or in small flocks essentially in dry, open scrub country.

Status? We have few definite records from Salsette. An enthusiastic 'shikari' once claimed to have shot some 'wood-cock' near Powāi and his description fitted this species beautifully! Mr. McCann caught one of these birds in Bombay City some years ago, and recently saw one at Marōl (December).

Breeding: Brother Navarro took several nests at Khandala (W. Ghats ca. 2,000 ft.) in April and May. The usual clutch is of 2 eggs, laid on the bare stony ground.

The Indian Courser: *Cursorius coromandelicus* (Gmelin).

Field identification: Size about that of the Partridge. General appearance somewhat like the Red-wattled Lapwing. Long, bare china-white legs. Upper plumage sandy brown with some black in the wings. Crown rich rufous. A black band through eye running down neck. A broad white stripe parallel to this band above the eye continuing down neck. These black and white bands are a conspicuous feature. Chin and throat white, breast chestnut, abdomen black. Singly, pairs or small parties, on open dry fallow land or ploughed fields. Running along at speed, stopping abruptly and erect and then resuming the run.

Specimens: *St. X. C.*: 2 ♀ juv., 3 ♀ juv., 3-6-33 Andhēri (H. A.).

Resident? Not common. H. A. observed a flock of some 40 birds about the base of Gilbert Hill, Andhēri (23-4-30). The next day there was only a single pair at that spot. The birds may be seen occasionally at the 'Kutcherpatti' on Trombay Island.

Breeding: That they breed in Salsette, occasionally at least, is evidenced by the juvenile specimens obtained on 3 June. The young birds are buff-coloured, barred on the upper parts with black presenting a mottled appearance. Iris dark grey. They had fed on small coleoptera and green caterpillars.

We have no other record for Salsette. Brother Navarro has taken nests at Khandala and Lonavla in June.

The Large Indian Pratincole or **Swallow-Plover:** *Glareola maldivarum maldivarum* (Forster).

Sinclair (*J.B.N.H.S.*, iii, 69) records shooting this species at Rewādanda. At Kihim (also in Kolāba Dist.) H. A. observed a flock of pratincoles, presumably this species, flying South over the sea along the coast at sunset (29-12-31). He noted the birds again on 30 December and 1 January (1932).

[**The Crab Plover:** *Dromas ardeola* Paykull.

Field identification: A lonely black and white bird, about the size of a domestic hen, with heavy crow-like beak, on seashore or tidal mudflats.

H. A. shot an example on the seashore near the fishing village of Thal, Kolāba Dist., on 26-10-30. He observed another near Rewās Pier (Dharamtar Creek) on the same date 5 years later.]

The Great Black-headed Gull: *Larus ichthyaëtus* Pallas.

Field identification: A large sea bird, in size between a duck and a goose. Pale grey above with black head and neck, white underparts and short orange-yellow legs. The toes are webbed like a duck's. In winter plumage which is mostly while the birds are with us, the head and neck are white, much streaked with black. Large size distinguishes it unmistakably from other gulls. Usually singly, about the Harbour and sea-coast, flying majestically or perched on the buoys.

Specimen: *B.N.H.S.*: ♂ 12-3-99 Trombay Island, Bombay Harbour (H. J. Walton).

Noted: About the docks, and Pir Pao (Salsette); Alibāg, Janjira, Rewādanda.

Winter visitor. Not common but frequent.

The Black-headed Gull: *Larus ridibundus* Linn.

Field identification: Similar to above but smaller. Size somewhat less than the domestic duck. The so-called black head is in fact chocolate-brown deepening to blackish on hindneck and lower throat. While with us the birds are mostly in winter plumage when the head is greyish-white. A vertical crescent-shaped black patch is conspicuous about the ear-coverts. Gregariously, often large numbers in association with the next species, about the docks and in the Harbour picking up floating refuse from ships. Also about fishing villages or following fishing boats returning from the catch.

Specimens: *B.N.H.S.*: 11 collected in Bombay Harbour between 28 December and 12 March.

Noted: Mahim and Sion Creeks.

Winter visitor. Fairly common. Latest date 4 April.

The Brown-headed Gull: *Larus brunnicephalus* Jerdon.

Field identification: Practically indistinguishable in size and colour from the above, especially in winter plumage. Doubtless often confused with it. In full summer dress the head is more greyish-brown than chocolate. In *ridibundus* the first primary is white with black edges and tip: in this species it is black with a white subterminal band. Habits, etc. as above.

Specimens: *B.N.H.S.*: ♂ 10-3-25 Bombay Harbour (C. McCann); [♀ 4-4-30 Alibāg (S.A.)].

Winter visitor. Bearing in mind the everpresent possibility of confusion it is our impression that this species is less common round Bombay than the Black-headed Gull. On the South Konkan Coast, however, Vidal (*S.F.*, ix, 94) considered it abundant and *ridibundus* very rare. Hume also definitely asserts (*S.F.*, iv, 414, 1875) that *brunnicephalus* is commoner in Bombay Harbour than *ridibundus*.

The Sooty Gull: *Larus hemprichii* Bruch.

Aberrant straggler. The only record for Bombay we know of is the solitary specimen seen by Hume on some rocks in the Harbour in January 1875 (*S.F.*, iv, 414).

The Eastern Herring Gull: *Larus fuscus taimyrensis* Buturlin.

Field identification: Rather larger than the three foregoing. In adult plumage dark slaty-grey above, white below with black in the flight feathers. In winter the head and neck are streaked brown; in summer they are white. Immature birds are dark brown with white streaks above and the white lower parts are mottled and streaked with pale brown. Gregariously, about docks and in the Harbour, and around fishing villages.

Specimens: *B.N.H.S.*: ♂♀ 9-3-14, ♀ 2-2-17, ♀♀ 23-1-10, ♂♂ 21-2-17 Bombay Harbour (S. H. Prater); ♂ 26-3-99 Bombay Harbour (Major H. J. Walton).

Winter visitor. Fairly common. Large numbers are occasionally seen about the fishing village of Dānda—near Bandra.

The Yellow-legged Herring Gull. *Larus argentatus cachinnans* Pallas.

Field identification: Very similar in size and colouring to the last and difficult to differentiate from it in the field. Somewhat paler grey above. Habits, etc. same as with other gulls.

Specimen: *B.N.H.S.*: ♀ 21-2-17 Bombay Harbour (S. H. Prater).

Winter visitor. Fairly common. Latest date 29 March.

The Indian Whiskered Tern: *Chlidonias hybrida indica* (Stevens).

Field identification: Size about that of the pigeon. A slender, graceful bird with long, pointed wings and an exceptionally square tail. In summer, plumage pale ashy grey above, white below gradually shading into black on abdomen and under tail. A velvety black cap. In winter, i.e. mostly while the birds are with us, the crown is white as are the entire lower parts. Only the hindcrown and nape are black-streaked or wholly black. Bill, legs and feet red. Gregariously, about tanks, marshes and creeks either flying back and forth at moderate heights scanning the water below for food or resting on some mudbank on their ridiculously short legs. They hurl themselves down on a fish or tadpole swimming near the surface or swoop gracefully on sand crabs, etc. and bear them away in their bills.

Specimens: *B.N.H.S.*: ♂ 22-9-24 Kūrla (D. B. Baretto); *St. X. C.*: [120 o?, 121 o? 13-10-33 Bassein, Thāna Dist. (H. A.)].

Noted: Powāi Lake, Gōdhbunder and Sion Creeks.

Status? Mainly winter visitor. Fairly common. We have noted individuals as early as 4 August and as late as 11 June. Do occasional birds or pairs stay with us throughout the year? And breed? A large flock at Powāi Lake on 4 May was evidently on passage. A female shot from this showed no gonadal development.

The Gull-billed Tern: *Gelochelidon nilotica nilotica* (Gmelin).

Field identification: Somewhat larger than the Whiskered Tern. Same general effect and habits but can usually be distinguished at a distance from other grey-and-white terns by its black bill, legs and feet.

Specimens: *B.N.H.S.*: ♀ 8-12-99 Bombay Harbour (E. Comber); ♀ 28-12-13 Bombay Harbour (N. B. Kinnear); ♂ 19-11-17 Kūrla (S. H. Prater); ♂ 1-9-18 Bhyandar (A. P. Kinloch).

Noted: Bandra, Vilé Parlé, Andhēri, Sion, Gōdhbunder—about creeks and mudflats.

Winter visitor. One of our commonest terns. By about the end of August the birds are well in. Numbers may still be met with at the end of May, while we have records of individual birds on 16 June, 23 and 24 July.

The Indian Lesser Crested Tern: *Thalasseus bengalensis bengalensis* (Lesson).

Field identification: Size and general effect that of the Gull-billed Tern. Distinguishable by its yellow bill and black legs and feet. Usually met at sea some distance from the shore, and also on the larger tidal creeks. The call *cher-ruk* while fishing in the manner of a Pied Kingfisher is characteristic.

Specimens: *B.N.H.S.*: ♂ 20-6-11 Bombay Harbour (S. H. Prater); ♀♀ 5-3-99 Bombay Harbour (Major H. J. Walton).

Winter visitor, principally. Not common. We have observed it when crossing the Harbour by the ferry service, and the bird becomes quite common as one goes further south.

The Little Tern or **Ternlet**: *Sterna albifrons albifrons* Vroeg.

Field identification: Differentiated from all our other terns by its small size which is about that of the Ring-Dove though the long wings and forked tail make it appear bigger in flight. Bill, legs and feet orange-yellow.

Specimens: *B.N.H.S.*: 3 ♀ and 1 ♂ 25-5-37 (H. A. and McCann).

Resident or breeding visitor? It is surprising that no specimens of the Little Tern had been taken, or the birds met with on our shores until the remarkable discovery recently of a nesting colony by Brother Navarro of St. Xavier's College. On 25 May 1936 Br. Navarro was rowed out by fishermen from Gorai, north of Manori Creek in Salsette, to a small rocky islet some 2-3 miles from the shore. This islet was crowded with Little Terns, the ground being covered with their nests mostly containing 3 eggs each. The fishermen collected close on 200 eggs. According to their testimony the birds had been breeding on this islet for years.

On 28 May of the following year H. A. visited this island again with Mr. McCann and Br. Navarro. The approach is extraordinarily difficult at this season, as the coast is rocky and a third of the island, which is less than 200 yards square, was covered by the tide. We anchored a couple of hundred yards off the rock, and waited for the tide to go down. Large flocks of these terns could be seen flying over the rock, and occasionally, they would cover some distance out to sea. No birds however came within gunshot, and we decided to swim the last hundred yards. The shore is extremely rocky, but there were two or three patches of level ground covered with a straggly growth of grass. The birds were not wild, and sat on their eggs 2 to 3 feet from one another. There must have been over a hundred nests. The eggs, 2 to 3 in number, were laid on the bare shingle, and one had to walk cautiously, to avoid stepping on them. They were all fresh. We shot a few specimens, and the birds became much wilder, and it was with some difficulty that we secured photographs of the birds at their nests. We saw no other birds except a *Thalasseus bergii* which just flew over the island.

On our return from the islet, a special watch for these Ternlets was kept, but we saw only a few stragglers, beating up and down the shore at evening. As there are no other records of this bird from our area it would appear that the species is possibly a breeding visitor only.

The Red Sea Brown-winged Tern: *Sterna anaetheta fuligula* Licht.

Field identification: Size about that of the Whiskered Tern, but with upper parts dark brown instead of grey. The black crown of the summer plumage is brown in winter with white edging to the feathers. The bill, legs and feet are black as in the Gull-billed Tern.

Specimens: *B.N.H.S.*: o? 23-9-18 Colāba, Bombay (Lieut. Tebbut); *St. X. C.*: 83 ♂, 84 ♀, 85 ♂ 17-9-33 Bandra.

Winter visitor. Not common. The St. Xavier's College specimens were captured by hand during the monsoon. They apparently were stragglers blown in by a gale. One was shot at Bandra on 15-11-38. The birds that Hume found breeding on the Vengurla rocks belong to the southern race *S. a. antarctia*.

[**The Indian Sooty Tern**: *Sterna fuscata infuscata* Licht.

Field identification: Size about that of the Gull-billed Tern. Upper parts deep chocolate brown. The black crown of the summer plumage is streaked with white in winter. Bill, legs and feet black.

Specimen: *B.N.H.S.*: o?—Alibāg, Kolāba Dist. (W. F. Sinclair).

Straggler. No other records.]

[**The Indian Skimmer**: *Rhynchops albicollis* Swains.

Field identification: A tern-like black, white and brown water bird chiefly remarkable for its orange-red scissor-shaped bill with the lower mandible compressed like a knife-blade and projecting much beyond the upper.

Specimen: *B.N.H.S.*: o? March 1890 Alibāg, Kolāba Dist. (E. L. Barton).

Straggler. The only record from our neighbourhood.]

Hume records (*S.F.*, iv, 414) meeting a single Caspian Tern (*Hydroprogne caspia*) and the Crested Terns (*Thalasseus bergii*) evidently in some numbers, near the Prongs Lighthouse and Colāba Point in January 1875. *T. bergii* is common further south.

The Turnstone: *Arenaria interpres interpres* (Linn.).

Hume (*S.F.*, iv, 414) found the Turnstone 'pretty abundant' all round Bombay Island and other islands in the Harbour in January 1875. We have no more recent records.

The Western Grey Plover: *Squatarola squatarola squatarola* (Linn.).

Field identification: A little larger than the Golden Plover, and much paler. In the hand, the presence of a tiny hind toe distinguishes it from that species.

Noted and/or shot: Malād (Salsette); Kihim (across Bombay Harbour).

Winter visitor. Not uncommon. Small parties—never large flocks—on seashore or by mangrove-fringed creeks and tidal mudflats.

The Oyster-Catcher or Sea-Pie: *Haematopus ostralegus longipes* Buturlin.

Field identification: Somewhat larger than the Partridge. A striking black and white wading bird with longish bare red legs and long, straight, moderately slender orange-red bill. Usually small flocks amongst rocks on the seashore and tidal mudflats.

Specimens: *B.N.H.S.*: o? October 1893 Alibāg, Kolāba Dist.; *St. X. C.*: 178 o? 22-10-33 Alibāg (H. A.).

Winter visitor. Common. Usually extremely wary. We have observed the birds here as early as 28 September and as late as 29 May. EHA (*C.B.B.*, 165) even saw a flock of about 15 not far from Bombay on 29 June. Hume (*S.F.*, iv, 414) noted several in Back Bay in January 1875. Their call notes resemble those of the Whistling Teal and in fading light when the birds are flying towards or away from one the effect is very teal-like.

The European Little Ringed Plover: *Charadrius dubius curonicus* Gmelin.

Field identification: Somewhat smaller than the Quail. A sandy-brown shore bird with a white forehead, black forecrown, earcoverts, around eye and a black collar round the white neck. Underparts white. Legs yellowish- or greenish-grey. A typical plover with a thick head, large eyes and short stout bill. Small flocks on the seashore and tidal mudflats.

Specimens: *B.N.H.S.*: oo 6-4-24 Sion Causeway (S. A.); ♀ 25-10-24 Kūrla (D. B. Baretto); ♀ 26-1-14 Colāba (S. H. Prater); *St. X. C.*: 36 ♀ 1-8-33, 105 ♀ 8-10-33 Andhērī (H. A.).

Noted: Mahāluxmi, Worli, Māhim, Dānda, Bhyandar, Trombay, Kihim, etc. EHA (*C.B.B.*, 164) mentions flocks frequenting the Esplanade Maidan.

Winter visitor. Common. Earliest date 11 August; latest 6 April. Flocks are commonly to be seen about the mudflats and salt pans in Salsette running along swiftly, feeding in company with Stints and other waders. In this environment their colouration is remarkably obliterative and it is often quite impossible to pick out a bird, even at close range until it moves.

We have no authentic record of the very similar Jerdon's Little Ring Plover (*C. d. jerdoni*) from our area. This race, as a rule, prefers the shingly banks and beds of rivers, streams and tanks inland.

Navarro has several records of this bird breeding at Khandala in June.

The Pamirs Lesser Sand-Plover: *Charadrius mongolus atrifrons* Wagler.

Field identification: Slightly larger than the foregoing. Ashy brown above pale rufous and white below. Head markings more or less like the Ring-Plover's, but lacking the white collar on hindneck. In winter plumage, while with us, the forehead, etc. are fulvous instead of black and the rufous of breast and flanks lesser in extent. Legs and feet greenish-grey, bill black. Flocks, running about feeding on sandy seashore especially between the tide marks. Also frequents tidal mudflats by creeks, etc.

Specimens: *B.N.H.S.*: 00 14-3-26 Bhyandar (S. A.); ♀ 25-10-24 Kūrla (D. B. Baretto); ♀ 28-9-13 Manori Creek (Dr. F. M. Suter); *St. X. C.*: 79 ♀, 80 ♂ 20-9-33 Versova mudflats (H. A.).

Winter visitor. Common and abundant. Earliest date 13 September; latest 14 March. Usually seen on the sea beach in mixed flocks with the Large Sand-Plover and other shore birds. The two species are in the proportion of something like 2 of *mongolus* to 1 of *leschenaulti*. They fly swiftly in close orderly formation all turning and twisting on the wing together with their white undersides glistening from time to time as the sun strikes them. When the flocks first arrive from their breeding grounds the birds have evidently not quite got over their 'territorial' instinct. Much rivalry is apparent and skirmishes are frequent. Their combats are as innocuous as amusing to watch. Two birds will run parallel to each other, heads lowered. Of a sudden one will turn on the other, rush at him with open wings and jump clean over him. Sometimes they vary these tactics and diverge as if oblivious of their adversary's proximity. Suddenly however they will wheel on each other and repeat the 'clinch'.

The Large Sand-Plover: *Charadrius leschenaulti* Lesson.

Field identification: Appreciably bigger than the Pamirs Sand-Plover and more rufous-sandy above, but otherwise the two are alike.

Specimens: *B.N.H.S.*: o? 23-9-18 Bhyandar (Lieut. Tebbut).

Noted: Near Gōdhbunder, Kihim, Alibāg, Karanja, Rewās, Rewādanda, Mūrūd (Janjira), etc.

Winter visitor. Common. Habits same as of the Lesser Sand-Plover. In the stomach of a specimen several of the beetles *Sphenoptera aenea* (Fam. Buprestidae) were found.

The Eastern Golden Plover: *Pluvialis dominicus fulvus* (Gmelin).

Field identification: Size about that of the Partridge. A typical plover with thick head, large eyes and short straight moderately stout bill. Mottled white, brown and golden-yellow above; black below. In winter the black is absent. Small parties or flocks on mudflats, etc. covered with short rank grass—moist lark country.

Specimens: *B.N.H.S.*: ♂♂ 2-11-08 Bhyandar (N. B. Kinnear).

Noted: Andhēri, Malād, Gōdhbunder, Bassein, Rewās, Kihim, Alibāg (Sākar Creek), Dharamtar Creek. J. D. Inverarity observed it on the Mahāluxmi mudflats in October 1877 and shot a couple on the Race Course. In March 1883 he saw a flock of a dozen near the Race Course (*J.B.N.H.S.*, ii, 44).

Winter visitor. Not uncommon. We have observed a flock of about 25 and a party of 4 (in summer plumage) on 24 August and 17 July respectively. They are frequently seen in our neighbourhood as late as the first half of May. The stomach of a specimen contained tiny snails and slugs.

The Sociable Lapwing: *Chettusia gregaria* (Pallas).

Field identification: Slightly larger than the Partridge. A greyish brown plover with wings and tail partly white and partly black. Black crown, white forehead, the white continuing in a broad stripe above eye down almost to nape.

Specimen: *B.N.H.S.*: ♀ 7-12-99 Esplanade, Bombay (J. M. Mason).

Aberrant straggler. EHA (*C.B.B.*, 164) writes that in December 1899 when the famine in Gujerat and the Deccan drove many strange birds to Bombay for a living, a flock of 40 or 50 of these plovers appeared on the Esplanade and remained for some weeks. They attracted much attention and were productive of letters in the newspapers.

The Indian Red-wattled Lapwing: *Lobivanellus indicus indicus* (Bodd.).

Mahrātti: *Hoot-toot-ti*; Hindūstāni: *Titori, Titwi.*

Field identification: Slightly larger than the Partridge and with longer legs and neck. Bronze-brown above, white below. Crown, throat and breast black. Lower back and tail white, the latter with a broad black cross-band. A crimson wattle or fleshy projection above and in front of each eye. Usually pairs or small parties, in open country near water. Familiar *Did-he-do-it?* calls.

Specimens: *B.N.H.S.*: ♂ 8-9-19 Bhyandar (A. P. Kinloch); [♀ 31-5-08 Vasind (S. H. Prater)].

Resident. Common.

Breeding: The earliest nest we have record of was on 29 March (Tūlsi Lake). The season is at its height between April and July. The nest is merely a natural depression or scrape in the ground, unlined, sometimes margined with pebbles or 'kankar'. It is usually situated on waste or fallow land more or less water-logged in the rains, and with deep imprints of cattle hoofs. The drying-up beds of village tanks also offer suitable sites. The normal clutch consists of 4 eggs, rather pointed at one end. In colour they are some shade of stone or grey-brown, blotched with blackish and match the ground to perfection. Indeed it is difficult to locate a nest even in a circumscribed area except by patiently watching the behaviour and movements of the owners. A successful method is to scan a likely patch from a distance with binoculars when the white on the head of the brooding bird will show up conspicuously. When suspicious the bird quietly slinks away from the nest with head held low between the shoulders only straightening itself up or flying off when some distance away. The colouration and markings of the newly hatched downy chicks of this Lapwing provide a very good example of Nature's camouflage. They are quite invisible at a couple of feet's distance when squatting or lying 'doggo' with neck outstreched. They run about freely picking up insects, etc., by themselves, to all appearances perfectly oblivious of possible danger, but respond mechanically to the alarm notes of their parents, squatting low beside a stone or clod and becoming completely invisible. When danger is past and immediately upon the signal from the parents—a series of high-pitched *clucks* as they wheel frantically overhead—they are up again and busy running about feeding with no semblance of caution on their own part. The parent birds launch fierce aerial attacks on crows, mynahs, kingfishers and even dogs and jackals that intrude into the proximity of their nest or young.

The Yellow-wattled Lapwing: *Lobipluvia malabarica* (Bodd.).

Field identification: Size about that of the Partridge, more leggy. Sandy brown above, white below with a black cap and bright yellow lappets above and in front of the eyes. Chin and throat black. Neck and breast paler than upper plumage. Tail white with a broad black subterminal band conspicuous in flight. Legs and feet bright yellow. Pairs or small parties, on waste and fallow land—usually drier facies than the Red-Wattled Lapwing.

Specimens. *B.N.H.S.*: ♂ 6-4-13 Santa Cruz (N. B. Kinnear); [♂ 24-12-00 Revdanda, Kolāba Dist. (E. Comber)].

Noted: Andhēri: Kihim (Kolāba Dist.).

Resident. Uncommon. Its call is very different from that of the Red-wattled Lapwing. It is a plaintive *Ti-ee, ti-ee,* etc., punctuated by high-pitched quick-repeated titters *twit-twit-twit*, etc.

Breeding: We have no record from Salsette, but at Kihim (Kolāba Dist.) across the Harbour—S. A. found downy chicks about 3 days old, on 24-6-30 on the same stretch of hoof-pitted waste land as was being used by the Red-wattled species. The chicks were stippled black and rufous and harmonised with the soil so completely that after roughly marking down the spot it took fully 10 minutes to locate one within 2 feet of his boot! The chicks were lying 'doggo' on the bare uneven ground without stone or clod as shelter. When a chick is once spotted, the broad white collar on its hindneck is prominent thereafter.

The parent birds demonstrate in the same frantically vocal manner as the foregoing species when their nest or young are approached, flying in circles close overhead often making as if to strike the intruder.

Navarro has taken nests at Khandala in May.

The Black-winged Stilt: *Himantopus himantopus himantopus* (Linn.).

Field identification: Size about that of the Partridge. A striking wading bird of black and white plumage chiefly remarkable for the length of its thin pink or red legs—about 10 inches—which enable it to wade into fairly deep water and which trail behind conspicuously in flight. Its bill is black, straight and slender. Singly, pairs or small parties on salt pans and mudflats by tidal creeks.

Specimen: *B.N.H.S.*: o? 29-9-24 Kūral (D. B. Baretto).

Noted: Bhyandar, Bassein, Alibāg (Sakar Creek), Naugaon and Nagotna (Kolāba Dist.).

Local migrant? All our records are between 29 September and 6 November only. Not uncommon but patchy.

The Avocet: *Recurvirostra avocetta avocetta* Linn.

Field identification: Size of the Stilt. Black and white plumage, long bare bluish legs and slender, black upcurved bill make its identity unmistakable. Singly or pairs—occasionally parties—by creeks and on tidal mudflats usually in company with 'snippets'.

Specimens: *B.N.H.S.*: ♂ 12-11-25, ♀ 25-11-25 Kūrla (D. B. Baretto); ♀ 11-3-04 Bombay (John Wallace); ♂♂ 27-2-15 Uran (A. H. A. Simcox); ♀ 6-12-18 Bombay Harbour (J. A. D. McBain); ♂ 23-9-18 Bhyandar (Lieut. Tebbut).

Noted: Bassein Creek (Thāna Dist.), Rewās mudflats, Sākar and Rewdanda Creeks (Kolāba Dist.).

Winter visitor. Sparingly but not uncommon. The feeding with the curiously shaped bill is effected as follows: The bill is directed against the ground obliquely so that the curved part skims the squelchy semi-liquid mud. The bill is then moved with a back and fore rotatory motion taking in small crustaceans, etc.

The Eastern Curlew: *Numenius arquata lineatus* Cuvier.

Field identification: Size about that of the domestic hen. A darkish sandy-brown bird streaked with black and fulvous to produce a game bird pattern, with white lower back and rump. Its most characteristic feature, however, is the curved slender bill 5 or 6 inches in length. The call, when once heard, is also characteristic—a shrill *coorlee* usually uttered in flight. Singly or parties on the seashore between tide marks. Also on mudflats and marshy land by tidal creeks. Extremely wary.

Specimens: *B.N.H.S.*: ♂ 6-12-18 Colāba Cove, Bombay Harbour (J. A. D. McBain); [♂ 1-9-11 Panvēl, Kolāba Dist., o? 25-12-10 Rewdanda (P. M. D. Sanderson)].

Noted and/ or shot: Gōrēgāon Creek; Bassein (Thāna Dist.) Inverarity (*J.B.N.H.S.*, ii, 45) saw a Curlew on Mahaluxmi Race Course on 26 September 1886, and EHA (*C.B.B.*, 170) writes that 'when the tide has run far out and bared the black rocks round Colāba and Breach Candy its wild and plaintive scream often comes in on the breeze'. Conditions have altered greatly, however, and we are aware of no recent record of the Curlew anywhere within town limits.

Winter visitor. Earliest date 20 August. Not uncommon across the Harbour and down the coast. Do some remain with us throughout the year? Sinclair (*J.B.N.H.S.*, i, 164) found them on the Konkan Coast all the year round.

[At Bedi Bunder in Kathiawar H. A. observed a Curlew on 12 June. At Rozi Bunder he found both Curlew and Whimbrel common on 16 June (*J.B.N.H.S.*, xl. 122).]

The Whimbrel: *Numenius phaeopus phaeopus* (Linn.).

Field identification: Rather smaller than the Curlew but very like it in colouration, general effect and habits. 'The call, uttered in flight, is a musical *tetti, tetti, tetti, tet* with rapid intonation. The dark crown with median whitish streak are often visible with the naked eye and obvious through glasses' (Meinertzhagen).

Specimens: *B.N.H.S.* ♂ 23-9-18 Bhyandar (Lt. Tebbut); [♂♂ 1-9-11 Panvēl, Kolāba Dist.]; *St. X. C.*: 81 o 20-9-33 Versōva Flats (H. A.).

Noted: Vasora (near Andhēri), Gōdhbunder; Kihim, Alibāg, Colāba Reclamation.

Winter visitor. Earliest date 20 July; latest 23 May. Commoner than the Curlew and usually in bigger flocks. We have seen several of nearly 100 birds each. They are very fond of the stretches of mangrove marshes along our tidal creeks, and may also be seen running about feeding on the seashore by the water's edge at low tide.

Both this species and the Curlew—as indeed are most of our migratory waders provided they are large enough to be worth powder and shot—are much persecuted by local shikaries.

The Black-tailed Godwit: *Limosa limosa* ssp.

Inverarity (*J.B.N.H.S.*, ii, 45) shot one among the salt pans at Penn (Kolāba Dist.) in February 1884.

H. A. obtained one from a party of 3 in tidal mud at Rewās (Kolāba Dist.) on 22-11-32.

The Bar-tailed Godwit: *Limosa lapponica lapponica* (Linn.).

Field identification: Size, colouration and general effect approximately that of the Whimbrel but with a straight, not curved, bill. Occurring in the same surroundings.

Specimen: *B.N.H.S.*: o? 23-9-18 Bhyandar (Lieut. Tebbut).

Noted only near Rewās Pier—Dharamtar Creek—12-3-30; a solitary example probing the mud near the jetty. On page 319 of vol. iv. of the *Journal* 2 Bar-tailed Godwits are recorded as received by the Society from Mr. Sinclair, Alibāg.

Straggler? As pointed out by S. A. in a note on the Bhyandar specimen (*J.B.N.H.S.*, xxxiii, 716) Bombay is considerably south of its hitherto known range in the Indian Empire.

The Terek or Avocet Sandpiper: *Xenus cinereus cinereus* (Gulden).

Field identification: Size about that of the Quail, brown above, white below in winter plumage while with us. Its most diagnostic feature is the long slender black bill noticeably upcurved like the Avocet's. Legs and feet orange-yellow which is unusual among Sandpipers. Parties or flocks on the seashore and tidal mudflats about the estuaries, usually in association with other small waders.

Specimens: *B.N.H.S.*: o? 23-9-18 Bhyandar (Lt. Tebbut); *St. X. Co*: o? Thāna (Nunes).

Noted: Malād; Rewās, Kihim.

Winter visitor. Earliest date 15 September: latest 12 April.

The Green Sandpiper: *Tringa ochropus* Linn.

Field identification: Size about that of the Snipe or the Quail, Head and neck greyish-brown. Upper parts dark brown with a bronze-green gloss. Lower parts, rump and tail white. The white rump, especially, distinguishes it in zig-zag flight from the somewhat similar looking but smaller and less dark Wood Sandpiper. The bill is slender, straight and snipe-like, but shorter than the Snipe's. Its call notes *twee-twee-twee* uttered when flushed and as the bird goes off are distinctive when once heard, Singly or couples at puddles and village tanks.

Specimens: *B.N.H.S.*: o? 2-1-11 Kheneri (Salsette): ♂ 16-12-18 Kūrla (S. H. Prater); *St. X. C.*: 77 ♀ 12-9-33 Andhēri, 52 ♀ 6-8-33 Gōrēgāon (H. A.).

Winter visitor. Common. Earliest date 5 August; latest 9 May.

The Marsh Sandpiper: *Tringa stagnatilis* (Bechstein).

Field identification: Rather smaller than the Green Sandpiper, but like the Greenshank in general effect. Its brown upper parts are more greyish than bronze-green. Lower back and rump white; tail brownish. Bill slightly recurved, this feature being obvious only at short range and through binoculars. Usually singly by tanks and flooded fields, standing in shallow water and probing the mud often with head submerged.

Specimens: *B.N.H.S.*: [♀ 26-12-09 Panvēl, Kolāba Dist. (N. B. Kinnear)]; *St. X. C.*: o?—Trombay.

Noted and/ or shot: Gōdhbunder Creek.

Winter visitor. Not common.

The Common Sandpiper: *Tringa hypoleucos* Linn.

Field identification: Slightly smaller than the Quail. Upper parts brown tinged with olive. Lower back and rump not white. White conspicuous only in outer feathers of tail. Lower parts white except breast which is suffused with pale ashy-brownish. A white wing-bar conspicuous in flight. Utters *tee-tee- tee* when flushed and going off. Singly, by tanks, puddles, creeks and about rocks on the sea beach.

Specimens: *B.N.H.S.*: ♀ 6-4-01 Bombay (J. M. Mason); ♂ 12-1-08 Andhēri (N. B. Kinnear?); ♀ 19-11-17 Kūrla (S. H. Prater); o? 16-11-25 Gōdhbunder (S. H. Prater); ♀ 16-12-18 Bombay (S. H. Prater); ♂ 1-9-18 Bhyandar (A. P. Kinloch); ♂ 2-10-24 Kūrla (D. B. Baretto); *St. X. C.*: 174 ♀ 1-8-33 Andhēri (H. A.)

Winter visitor. Common. Birds already begin to arrive in some numbers in the first week of August and may be commonly seen till about the middle of May. Occasional individuals, however, remain in our midst throughout the year but they do not breed at this latitude.

The Wood or **Spotted Sandpiper:** *Tringa glareola* Linn.

Field identification: Size about that of the Green Sandpiper. Sepia brown above indistinctly spotted and marked with white. Back and rump white. Breast pale brownish. Whitish stripe above eye. Singly or small parties—larger flocks later in the season prior to emigration—by flooded fields, tanks, shallow vegetation-covered jheels, etc.

Specimens: *St. X. C.*: 123 o Bassein, Thāna Dist. (H. A.).

Noted: Andhēri, Bhandūp, Powāi Lake.

Winter visitor. Not uncommon. Earliest date 14 September; latest 9 May. H. A. observed a solitary example on 20 July (35).

The Redshank: *Tringa totanus eurhinus* (Oberholser).

Mahrātti: *Maater.*

Field identification: Larger than the Green Sandpiper, and unmistakably of the tribe in general effect. Greyish-brown above, streaked and spotted with white. Back white, specially conspicuous in flight when the long slender red legs trail behind. A white bar in wings. Utters a sharp *tiwee-tiwee-tiwee* or *tew-tew-tew* as it flies off. Singly or small parties at tanks, about mangrove-lined creeks, tidal mudflats and salt pans.

Specimens: *B.N.H.S.*: ♀ 27-11-99 Hog Island, Bombay Harbour (E. Comber); ♂ 8-9-18 Bhyandar (A. P. Kinloch); ♂ 2-11-08 Bhyandar (N. B. Kinnear); [♀ 25-12-09 Panvēl, Kolāba Dist. (N. B. K.)]; *St. X. C.*: 124 ♀ 13-10-33 Bassein, Thāna Dist. (H. A.).

Winter visitor. Fairly common, but not abundant. Earliest dates 29 July and 19 August; latest 25 May. On the latter date a flock flying abreast in a ribbon at about 3-400 feet in N. direction, apparently emigrating.

The Greenshank: *Glottis nebularia* (Gunnerus).

Field identification: Size about the same as or slightly larger than the Redshank. Darker greyish-brown above, with white rump. White below.

Distinguishable from the foregoing by absence of white wing-bar, by its olive green instead of red legs and by its long slender bill being slightly upcurved. Its call *tew-tew-tew* is very like that of the Redshank. Usually singly in the same surroundings as last.

Specimen: *B.N.H.S.*: ♂ 2-11-08 Bhyandar (N. B. Kinnear).

Noted: Andhēri, Malād, Mahūl, Trombay, Gōrēgāon, Gōdhbunder; Kihim, Alibāg, Dharamtar.

Winter visitor. Fairly common, but not abundant. Earliest date 8 August; latest 18 June. At 6-30 p.m. on 2 May (1930) a flock of about 100 Greenshanks was observed at Sākar Creek (Alibāg) hugging the coast and flying strongly due North in ribbon formation—all abreast—at a height of about 500-600 feet.

Almost all sandpipers and allied waders, big and small, pass locally under the name of *Timbla*.

The Ruff and Reeve: *Philomachus pugnax* (Linn.).

Field identification: Male slightly larger than the Redshank: female appreciably smaller. A wader with noticeably short sandpiper-like bill. Upper plumage in winter, while with us, brown mottled with black and buff; white below, the breast suffused with brown or buff. Small flocks, mixed with other waders on tidal mudflats and paddy stubble by creeks, etc.

Specimens: *B.N.H.S.*: ♀ 23-9-18 Bhyandar (Lt. Tebbut); *St. X. C.*: ♀ 19-10-33 Alibāg (H. A.).

Noted: Bassein (Thāna Dist.): Naugaon (Kolāba Dist.).

Winter visitor. Uncommon but possibly often overlooked or confused with other species.

The Little Stint: *Erolia minuta minuta* (Leisler).

Field identification: A diminutive wader slightly bigger than the Sparrow. Mottled greyish-brown above, white below. Outer tail-feathers brownish. Flocks on mudflats and the sea beach in association with other stints and shore birds. When disturbed the flock flies off swiftly in orderly mass formation turning and wheeling in unison and uttering a musical *wit-wit-wit* or low *tr-rr*. The black legs distinguish this bird from Temminck's Stint, the legs of which are olive green.

Specimens: *B.N.H.S.*: ♀ 21-11-08 Bhyandar (N. B. Kinnear); oo 6-4-24 Sion Causeway (S. A.); o? 26-11-25 Kūrla (D. B. Baretto).

Noted: Andhēri, Māndwa, Rewās, Alibāg (Kolāba Dist.).

Winter visitor. Common. Earliest date 25 Sept. latest 6 April.

Temminck's Stint: *Erolia temminckii* (Leisler).

Field identification difficult. Size and general effect same as of the Little Stint, but with the outer tail-feathers white. In the hand distinguishable by the shaft of the first primary being white, the others brown. In *minuta* all shafts of primaries are more or less white. Habits same as last, though in smaller flocks and perhaps more often by fresh water tanks, etc.

Specimens: *B.N.H.S.*: ♀ 23-3-85, o? 25-3-85 Bombay (EHA); *St. X. C.*: 112 ♀ Salsette, 207 ♀ Decr. 34 Andhēri (H. A.).

Winter visitor. Less common than the Little Stint. Often in association with it and with mixed flocks of other waders.

The Curlew-Stint or **Pigmy Sandpiper**: *Erolia testacea* (Pallas).

Field identification: Size about that of the Common Sandpiper. Upper parts grey-brown with a good deal of white streaks and mottling. Upper tail coverts mostly white. Lower parts white with brownish wash on breast. Its diagnostic feature is the slender curlew-like bill decurved towards the tip. Parties amongst mixed flocks of small shore birds on tidal mudflats, etc.

Specimen: *St. X. C.*: 216 o? 7-10-35 Bassein, Thāna Dist. (H. A.)

Winter visitor. Common, but overlooked as a 'kūch-nai'.

The Dunlin: *Erolia alpina alpina* (Linn.).

Field identification: Size about that of the Common Sandpiper. Colouration and general effect as the last but with upper tail coverts blackish brown, clearly noticeable in flight. The bill is decurved but to a lesser extent than in the Curlew-Stint. The proportionately longer bill is a characteristic feature of the Dunlin as is also the rounded 'hunch back' profile when at rest. Small flocks in company with other waders on tidal mudflats and the seashore.

Specimens : 00 Decr. 1932 Trombay (Rev. Palacios) ; 137 ♀ 20-10-33 Rewās Kolaba Dist. (H. A.).

Noted : Andhēri.

Winter visitor. Uncommon.

The Broad-billed Sandpiper : *Limicola falcinellus* subspecies?

Field identification : Size about that of the Common Sandpiper. General effect as of the Dunlin. Upper parts ashy-brown, lower white. Breast finely streaked with brown. Its diagnostic feature is the bill which is depressed and broad. Singly or small parties, by puddles, etc. on tidal mudflats and seashore, frequently in mixed flocks of waders.

Specimens : *B.N.H.S.* : 0? 23-9-18 Bhyandar (Lt. Tebbut) ; *St. X. C.* : [135 ♀, 136 ♂ Rewās, Kolāba Dist. (H. A.)].

Noted about Rewādanda Creek—1st week of November 1933 (Rev. Palacios).

Winter visitor. Not common. The races cannot be differentiated in winter plumage.

The Woodcock : *Scolopax rusticola rusticola* Linn.

Field identification : Size about that of the Pigeon. General effect that of an overgrown Snipe.

In *Stray Feathers* (vol. vii, p. 525) J. D. Inverarity records one shot by R. D. Cairns of the Oriental Bank 2 miles from Thāna on Christmas Day, 1878. It was flushed in bushes at the foot of some low hills near marshy ground.

This individual was obviously an exhausted passenger. Some Woodcock regularly winter in the Nilgiris and adjacent hills, but if this is their usual route they must pass over without stopping for there is no other record of their occurring in our area.

The Wood Snipe : *Capella nemoricola* (Hodgs.).

Field identification : This and the two following, namely the Common and the Pintail Snipe are difficult to differentiate in the field except with constant practice. Size slightly larger than the Quail. Dark brown above streaked with black, rufous and buff. Very obliterative colouration, blending admirably with the surroundings. Paler or whitish below. Long, straight slender bill about 2½ inches. Singly or wisps on grass-covered marshes, squelchy paddy stubble and also on tidal mudflats along creeks with rank grass cover, mangroves or other bushes. Rising with a harsh note *pench* or *scape* like the squelching of a sodden shoe, and flying off swiftly in zig-zags.

Specimen : *B.N.H.S.* : ♀ 18-1-17 near Thāna (Major M. L. Ferrar).

One was shot near Bombay by T. H. Moore in January 1896 (*J.B.N.H.S.*, xxv, 149).

Winter visitor. Rare, but perhaps not always identified even in sportsmen's bags.

The Common or Fantail Snipe : *Capella gallinago gallinago* (Linn.)

Field identification : See *supra*.

Specimens : *B.N.H.S.* : 0? 13-1-95 Thāna (W. J. Pringle) ; ♀ 20-1-09 Thāna (N. B. Kinnear) ; ♀ 6-2-19 'Near Bombay' (H. A. W. Brent) ; ♀ 7-3-21 Thāna (B. C. Ellison) ; ♀ 3-12-23 Thāna (R. A. Spence) ; *St. X. C.* : [126 ♀ 15-10-33 Kihim, Kolāba Dist. (H. A.)].

Noted and/ or shot : Gōdhbunder, Tūlsi Lake, Irla, Vilé Parlé.

Winter visitor. Common. Earliest date 18 September ; latest 4 May.

EHA (*C.B.B.*, 167) mentions that snipe were shot on the Flats (meaning chiefly about Mahāluxmi and Tārdeo) every year. Conditions have altered greatly since that time and suitable marshes no longer exist within town limits. The snipe have gone the way of the malarial mosquito.

The Pintail Snipe : *Capella stenura* (Bonaparte).

Field identification : See *supra*. In the hand it may readily be distinguished from the Fantail by the 26 or 28 attenuated pin feathers in the tail as against 12 to 14 normal ones in the Fantail.

Specimens: *B.N.H.S.*: o? December 1890 Bombay (E. L. Barton); ♀ 27-12-10 Bhāndūp (J. L. Symons); ♂ 25-1-13 Santa Cruz (N. B. Kinnear).
Noted and/ or shot: Gōdhbunder, Vilé Parlé, Powāi Lake.

Winter visitor. Earliest date 24 September; latest 3 April. We agree with Inverarity who wrote in 1879 (*S.F.*, vii, 526) that about Thāna and on the snipe grounds across the Bombay Harbour the Pintail forms the majority in bags.

The Jack Snipe: *Lymnocryptes minima* Brunnich.

Field identification: Smaller than the Quail. Like the Common Snipe but with a metallic green and purple sheen on the back visible in the hand. Bill shorter than the Common Snipe's. Singly or wisps on marshy ground. Requires heavier cover in the nature of reeds and bulrushes than the Fantail or Pintail Snipe. Rises silently. Zig-zag flight less swift.

Specimens: *B.N.H.S.*: ♂♀ 25-1-05 Thāna (W. S. Millard); ♂ 8-1-10 Thāna (N. B. Kinnear); ♂ 3-12-23 Panvēl, Kolāba Dist. (P. M. D. Sanderson).
Noted and/or shot; Gōdhbunder, Vilé Parlé.

Winter visitor. Common.

The Little Cormorant: *Phalacrocorax niger* (Vieillot).

Mahrātti: *Pan-kaula*.

Field identification: Size about that of the Jungle Crow. All black. Long neck, stiff tail, slender bill sharply hooked at end. A water bird usually seen swimming, perched on a tree near water or sunning itself with open wings on some rock or stake. Singly or gregariously on tanks and lakes.

Specimen: *St. X. C.*: [132 ♀ 20-10-33 Rewās, Kolāba Dist. (H. A.)]
Noted: Tūlsi and Tānsa Lakes.

Resident. Not common.

Breeding: On 1 September (1935) H. A. found several pairs nesting on large trees in company with Night Herons in the midst of Thāna town. Most of the nests contained half fledged young. The nests are made of twigs and resemble those of the Crow. A normal clutch consists of 3 to 5 eggs, dirty chalky white, narrow and pointed at both ends.

The Indian Shag (*Phalacrocorax fuscicollis*) may also occur in our area. H. A. has doubtfully observed it at Kihim across the Harbour.

The Indian Darter or **Snake Bird**: *Anhinga melanogaster* Pennant.

Field identification: Size that of a small duck. A black bird with silver-grey streaks on the back, and brown head and neck. Chin and throat white, speckled with brown. Tail long and stiff. The long slender S-shaped neck, narrow head and pointed dagger-like bill are characteristic features of the Darter. When on the water only the snake-like neck and head are visible. In flight—attained by rapid wing beats as in the Cormorant—the thin neck is held outstretched. Perches in branches above water whence it tumbles down into it on alarm, diving and swimming away swiftly below the surface. Singly or small loose parties at tanks and lakes.

Resident? Not common. We have only observed occasional examples at Tūlsi and Powāi Lakes in Salsette. Also at Tānsa. Its food consists of fish which are chased and captured below the surface.

The Red Sea Masked Booby or **Gannet**: *Sula dactylatra melanops* Heuglin.

Field identification: Size that of a large duck. White all over except wings and tail which are chocolate brown. Naked skin of face dark slaty blue. Heavy pointed bill greenish yellow.

Specimens: *B.N.H.S.*: o? 25-7-02 Bombay Coast; o? 28-7-27 Parel, Bombay (C. Wood).

Straggler. Blown in periodically by gales of the South-west Monsoon. Other records from Bombay are:

2 specimens captured by E. R. H. Jackson of the Bombay Port Trust in 1909 and 1912 respectively (*J.B.N.H.S.*, xxi, 1334).

1 Uran 10-8-1914.

The Persian Shearwater: *Puffinus persicus* Hume.

In the B.N.H.S. Collection there is a specimen (o?) obtained at Alibāg in July 1885 by W. F. Sinclair, presumably blown in by monsoon gales.

The Indian Spoonbill : *Platalea leucorodia major* (Temm. & Schlegel).

Field identification : A large snow-white egret-like bird with a distinctive flat spatula-shaped bill. Singly or flocks, by tanks, jheels and marshes.

Local visitor? Rare. H. A. observed it on the tidal mudflats near Avās (Kolāba Dist.) across the Harbour, on 21-10-32. It is not uncommon in Nasik District.

The White Stork : *Ciconia ciconia ciconia* (Linn.).

Field identification : A large long-necked, long-legged egret-like bird standing about 4 feet to the top of its head. White—with black wing-quills. Legs and the heavy pointed bill red. Singly, pairs or small parties on and about marshes.

Specimen : *B.N.H.S.* : o? 11-11-25 Kūrla (D. B. Baretto).

Noted : Sion mudflats (a solitary example 10-11-27). One seen from the train at Bassein (on mudflats).

Winter visitor. Rare.

The White-necked Stork : *Dissoura episcopa episcopa* (Bodd.).

Field identification : Similar to but smaller than the White Stork—standing about 3 ft. to top of head. Black except neck, abdomen and undertail which are white. The crown is black and looks like a padre's skull cap. Singly, by water or marsh.

S. A. observed a solitary example on the edge of Vihār Lake 16-3-24 and a pair on Sākar Creek, near Alibāg, in April 1930.

Local migrant. (Straggler?) Rare.

The Painted Stork : *Ibis leucocephala leucocephala* (Pennant).

Field identification : Size about that of the White Stork. White, closely barred and marked with metallic black above, and a black band across breast. Striking rose-pink about the shoulders. Long, pointed, heavy yellow bill slightly decurved near tip. Unfeathered yellow face. Pairs or parties, by tanks and marshes.

Specimen : *B.N.H.S.* : o?—Bombay Harbour (W. S. Millard).

Straggler. There are no other records and we have not come across this stork in our neighbourhood.

[**The Open-billed Stork** : *Anastomus oscitans* (Bodd.).

Field identification : Size small for stork. Greyish-white with black in wings. Distinctive reddish-black bill with the mandibles not fitting closely but leaving a narrow gap between them. Pairs or flocks, about tanks and marshes.

S. A. noted a couple at Vaishwi Tank near Alibāg town on 19 May 1930, and H. A. observed a large flock at Wassin (opposite Rewās) in Dharamtar Creek on 23-11-32. The birds were on a soft squelchy tidal mudflat in association with numerous ducks and waders.

Local migrant. Rare.]

The Eastern Purple Heron : *Ardea purpurea manillensis* Meyen.

Field identification : A large slender egret-like bird about the size of the Open-bill, with long thin S-shaped neck and pointed dagger bill. Bluish-grey and slaty with neck and head chiefly rufous. Breast and abdomen black and chestnut. A long black crest. Typical heron flight with neck drawn in and legs trailing behind, unlike storks and cranes which fly with neck extended. Solitary, usually standing in water at edge of reed-covered tank or on mudbank in creek, etc. Stalks along the edge of reed-beds in knee-deep water, peering intently into it with poised bill, 'freezes' suddenly and jabs its bill to snap up some fish or frog with lightning rapidity.

Specimen : *B.N.H.S.* : [♀ 2-12-12 Bassein, Thāna Dist. (R. dos Remedios)].

Noted : Powāi and Tūlsi Lakes.

Resident? Not common. No breeding record from our area.

The Common Grey Heron : *Area cinerea cinerea* (Linn.).

Field identification : Size and general effect as above but ashy-grey with whitish crown, neck and abdomen. Long black crest. A conspicuous black and white line down middle of foreneck. Habits, etc. same as of the Purple Heron.

Noted: Powāi Lake (on reedy shallow margin); Gōdhbunder Creek (in mangroves and tidal mud along banks); Kihim (on rocky seashore).

Resident? Not common. No breeding record from our area.

The Large Egret: *Egretta alba* subspecies?

Field identification: Size about that of the Heron. Pure white, with black bill, legs and feet. Solitary, at edge of tanks and creeks.

Noted: Powāi Lake: Rewās (Kolāba Dist.).

Status? Rare. The note, usually uttered in flight, is a harsh *Kraa-krr.* Navarro found this bird breeding with *E. intermedia, A. grayii* and *E. garzetta* at Karjat in July.

The Indian Smaller Egret: *Egretta intermedia intermedia* (Wagler).

Field identification: Like the Large Egret but smaller. Usually gregariously in same biotope as last.

Noted: Powāi and Tūlsi Lakes. Rewas (Dharamtar Creek) Kolāba Dist.

Resident. Fairly common.

Breeding: By the middle of May the birds have commenced putting on their dainty ornamental breeding plumes on the head, breast and back. We have no breeding record in our area, but Barnes (*J.B.N.H.S.*, vi, 142) found nests on a tree near 'Wassind' (Vāsind) Station on the G.I.P. Railway, about 50 miles from Bombay, in July. The birds nest in colonies, building crow-like twig nests in trees, either by themselves or in association with herons and storks. The normal clutch consists of 4 pale bluish-green eggs.

The Little Egret: *Egretta garzetta garzetta* (Linn.).

Field identification: Smallest of the three. Size that of the more familiar Cattle Egret. Pure white in colour and a small replica of the preceding two in all respects. Usually flocks in same biotope and often in association with the Smaller Egret.

Specimen: *B.N.H.S.*: [♂ 12-5-18 Kihim (S. H. Prater)].

Noted: Powāi and Tūlsi Lakes, Gōdhbunder; Rewās.

Resident. Fairly common.

Breeding: Barnes (*J.B.N.H.S.*, vi, 144) records a large colony nesting in a tree near Vāsind village (G.I.P. Railway—ca 50 miles from Bombay) in July. In the same tree were also nesting Cattle Egrets and Paddy Birds. The nests are similar to those of the foregoing species, the eggs differing only in being smaller. There are several mixed egret colonies round Bombay, e.g. Vajrabai Hot Spring, Karjat; and further observation might produce interesting information. Some years ago these egrets used to be extensively and lucratively farmed in Sind for the sake of their ornamental breeding plumes. With the change in women's fashions, egret feathers no longer carry the same demand, and prices have also dwindled accordingly. But some small farms exist even to this day. Egret farming could still become a profitable cottage industry if export of farm produced feathers to foreign countries were licensed and their production properly organised and controlled. A good account of Egret Farming in Sind will be found on pages 748-749 of vol. xxviii of this *Journal.*

The Cattle Egret: *Bubulcus ibis coromandus* (Bodd.).

Mahrātti: *Gochandi-khao*; Hind.: *Gāi-bagla.*

Field identification: A familiar lanky bird about the size of a country hen with longish, pointed yellow bill. In young birds the bills are black and they are then easily confused with the Little Egret. Pure white and very like the Little Egret except in the breeding season when it acquires golden buff plumes on head, neck and back. Gregarious; usually in attendance on grazing cattle, snapping up grasshoppers, etc. disturbed in the animals' progress. Often far from water.

Specimen: *B.N.H.S.*: o? 8-9-18 Bhyandar (A. P. Kinloch).

Noted: *City*: Bhūleshwar, Khētwadi (1912), Chowpāti, Malabār Hill, Mahāluxmi; *Suburbs and Salsette*: Bandra, Khār, Chembūr, Powāi Lake, Gōdhbunder, etc.

Resident. Common. S. A. has observed an individual for days at Bhūleshwar, in the heart of the bustling bazaar, on a tree partly overhanging a half dry temple tank and partly a halwai's shop. The bird spent its time picking off the flies disturbed off the sweetmeats in the stall beneath from time to time and alighting on the tree for respite! Flies appear to be greatly relished. We have noted another individual at Chowpāti who was in the regular habit of eating flies off a toddy pot hung on a tapped cocoanut palm for collecting the juice.

Breeding: By the first week in May, many birds have already donned their golden breeding dress, and by the end of that month this is general. Building operations commence by about the middle of May and nesting continues till August. The birds nest in colonies selecting some large tamarind or other tree, in or near a village, for the purpose. This tree is usually shared by Paddy Birds and Little Egrets. We have noted such nest colonies opposite Bandra railway station, in Andhēri bazaar, in Borivli village, and at Mahāluxmi. The same trees are used for several years in succession. 15 to 25 nests is not an unusual number for a colony. The nests are untidy twig structures like those of the Crow. Three to five eggs form a normal clutch. They are a pale skim milk blue in colour.

The stomach of a fledgling examined was packed with grasshopper remains, a small crab and about 200 Blue-bottle flies (*Musca vomitoria*).

Barnes (*J.B.N.H.S.*, vi, 142) found the Cattle Egret nesting at Vāsind (G.I.P. Railway) in July.

The Indian Reef Heron : *Demiegretta asha* (Sykes).

Field identification: Size about the same as, or slightly larger than the Cattle Egret. Very similar in general effect to the Small Egret but found in 2 colour phases: (1) White, (2) Slaty-grey. Occasional birds are intermediate being partly white and partly grey. Singly or pairs about rocky seashore, mangrove-lined creeks and tidal mudflats.

Specimen: *B.N.H.S.*: [21-11-10 Panvēl, Kolāba Dist. (N. B. Kinnear)]

Noted: Mahim, Andhēri, Bhyandar, Mahūl, Kihim, Rewās, Hornby Vellard.

Status? Our records are only between 18 October and 20 May. Not uncommon but sparingly.

The Indian Pond Heron or Paddy-Bird : *Ardeola grayii* (Sykes).

Field identification: Size about the same as or slightly less than the Cattle Egret. Most of the plumage white, concealed by an earth-brown mantle so that when at rest on the edge of a tank the bird is almost invisible. As soon as it rises, however,—usually with a croak—the white wings, back and underparts flash into prominence. Singly or gregariously at every piece of water-pool, puddle or tank, inundated paddy-field, creek or on the seashore. Especially fond of village tanks in the process of drying up.

Specimen: *B.N.H.S.*: ♂ juv. 14-7-13 Colāba, Bombay (S. H. Prater).

Resident. Very common. Its food consists for the most part of frogs. Its normal method of hunting is to wade into water or stand poised on the edge as still as a dummy and dart at any prey coming within striking range.

Breeding: By about the middle of April the birds commence to don their nuptial plumage. The back becomes rich maroon. A long white occipital crest is developed and the legs and feet—normally greenish-yellow—assume a beautiful salmon-pink tint. By the middle of June the majority of birds are in full breeding dress. Most nests are found between July and September. Paddy-birds breed in colonies in association with other egrets and Night-Herons. Their nests are untidy platforms of twigs like those of the Crow, built in large trees such as tamarind or mango. We have observed nest colonies at Bandra (opposite railway station), Victoria Gardens (Byculla), and in the midst of Thana town. Barnes (*J.B.N.H.S.*, vi, 142) found nests at Vāsind (about 50 miles from Bombay) in July. A normal clutch consists of 3 or 4—rarely 5—pale greenish-blue eggs.

The Indian Little Green Heron : *Butorides striatus javanicus* (Horsf.).

Field identification: Slightly smaller than the Paddy-bird. Above slaty or blackish-grey glossed with bronze green; below paler grey. Singly by rocky or mangrove-lined tidal creeks, pools, etc. Occasionally found at rocky hill streams.

Specimens: *B.N.H.S.*: ♂ 3-11-20 Kennery Island, Bombay Harbour (V. S. La Personne); 3 nestlings 30-5-37 Gōdhbunder (C. McCann).

Noted: Mahūl, Andheri, Powāi and Tūlsi Lakes.

Resident. Fairly common, but unobtrusive. The stomach of a specimen contained shrimps and mudfish (*newtas*).

Breeding: On 30 May Mr. C. McCann found a nest in a mangrove bush near Gōdhbunder Creek. In structure it was like that of the Paddy-bird. It contained 3 young in down—with the wing quills sprouting—which were able to clamber about the branches.

The Night Heron: *Nycticorax nycticorax nycticorax* Linn.

Mahrātti: *Raat-baggal* or *Raat-koku.*

Field identification: Larger than the Paddy-bird. Of the same general effect, but with an appreciably stouter bill. An ashy-grey bird with black crown, nape and long crest at back of head, the last with some white feathers in it. Lower parts chiefly whitish. Young birds are brown, streaked with rufous. Their underparts are white broadly streaked with dark brown. Colonies, roosting in favourite large trees during the day and flying out in parties at sunset with loud raucous *kwaaks* to feed at tanks and creeks.

Specimens: *B.N.H.S.*: ♂ 28-7-14 Carnac Bunder, Bombay (Counsell); ♀ 27-11-99 Hog Island, Bombay Harbour (E. Comber).

Hume (*S.F.*, iv, 415) disturbed a large colony on Elephanta Island and shot a few in January 1875.

Resident. Common. Considered finest 'game bird' in Salsette and much persecuted by local 'sportsmen'!

Breeding: The Night Heron nests in colonies which often extend over several adjacent trees, between June and September. They build the usual twig nests of the Crow pattern often sparsely lined with leaves. We have records of large colonies on *Pithecolobium* trees in Victoria Gardens, Bombay, and in Thāna town where almost every available Banyan and Peepal tree is utilised. The eggs—usually 3 or 4—are pale greenish-blue in colour. The young birds soon leave the nest and clamber about the neighbouring branches keeping up an incessant *click, click, click,* etc. The din which a nesting colony at this stage produces can be heard fully half a mile away.

Stomachs of fledgling Night Herons examined by us contained among other things a fresh unbroken Night Heron egg, a leg of embryo of same, remains of *Gerardia praevestiana* and shrimps, etc.

Barnes (*J.B.N.H.S.*, vi, 415) found the Night Heron breeding on islets in the Vihār Lake, and at Elephanta, in August.

The Yellow Bittern: *Ixobrychus sinensis sinensis* (Gmelin).

Field identification: Somewhat smaller and slenderer than the Paddy-bird but of the same general effect. Yellow, brown, rufous and chestnut predominating in plumage. Black crest. Singly, by edge or reedy swamps and occasionally mangrove-lined creeks. Unobtrusive, creeping away surreptitiously when suspicious.

Specimens: *B.N.H.S.*: ♂ 25-1-09 Thāna (N. B. Kinnear); *St X. C.*: 268 ♂ juv. 21-11-36 Powāi Lake (H. A.).

Resident. Not common.

The Chestnut Bittern: *Ixobrychus cinnamomeus* (Gmelin).

Field identification: Similar to above, but with upper parts chestnut-cinnamon, lower pale chestnut. Habits, etc. same as of the Yellow Bittern.

Noted: Powāi Lake; Kihim (Kolāba Dist.).

Fairly common among the reeds at Powāi Lake. Inverarity (*J.B.N.H.S.*, ii, 45) shot them at Gōdhbunder and also one near Penn (Kolāba Dist.) on 28-11-1886.

Breeding: H. A. observed a bird carrying twigs on two consecutive days in August, near Powāi but failed to find the nest. Navarro has found several nests at Khandala and Karjat during May, June and July.

The Bittern : *Botaurus stellaris stellaris* (Linn.).

Field identification : Considerably larger than the Paddy-bird. Short, stout, pointed bill and large feet. A buff coloured bird of the general effect of the Paddy-bird with black back and blackish streaks and barring on rump and in the lower plumage. Singly, in reed beds and shrubbery on marshes.

Specimen : *B.N.H.S.* : ♀ 4-12-16 near Thāna (A. F. Forbes).

Winter visitor. Rare. We have not come across the Bittern in our area, but J. D. Inverarity (*S.F.*, vii, 526, 1879) believed it to be not uncommon, though seldom seen. In 8 years he had only seen three. One he shot on 22-10-1877 on the 'Flats' half a mile from Byculla Club, close to the railway and 'within 200 yards of the Foras Road which crosses the flat from Bombay to Worlee'. The second he saw on 12-1-1878 on Bhiwandi Tank and the third he shot on 24-2-1878 at Panvēl. He also saw several others subsequently (*J.B.N.H.S.*, ii, 44). Mr. Kotwal shot a specimen at Parle on the 3rd January 1939.

The Flamingo: *Phoenicopterus ruber antiquorum* Temm.

Marāthi : *Rohi.*

EHA (*C.B.B.*, 167) records seeing an example not far from Hog Island in Bombay Harbour. In April and May 1930 two flocks (or the same flock?) of about 12 birds were observed at Alibāg and Kihim (Kolāba Dist.), respectively flying along the seashore in a northerly direction. There are several other records for May and this bird is probably a common passage migrant.

The Lesser Flamingo : *Phoeniconaias minor* (Geoffr.).

In the old card catalogue of birds in the B.N.H.S. Collection, prepared by Mr. N. B. Kinnear, there is listed a specimen ♀ 2-1-1898 Thāna (J. Mason). We have not seen the specimen and have no further details.

The Nukta or **Comb Duck** : *Sarkidiornis melanotus* (Pennant).

Field identification : Larger than the domestic duck. Black above glossed with green and blue; white below. Head and neck white speckled with black. A comb or knob at forehead near base of bill in the male.

Inverarity (*J.B.N.H.S.*, ii, 45) records the shooting of a solitary young of the year at Penn (Kolāba Dist.) on 28-11-1887. We know of one other shot at Kihim (Kolāba Dist.) in May a few years ago.

Local straggler.

The Cotton Teal : *Nettapus coromandelianus* (Gmelin).

Field identification : The smallest of our ducks. Size between the Pigeon and the Jungle Crow. Rather similar in colouration to the Nukta. Bill goose-like, not as flat as the duck's. In flight whitish edge of wing conspicuous in male.

Specimens : [♂ ♀ 7-12-09 Daman Road, B.B. & C.I. Rly. (R. L. Sinclair)].

Noted : A pair on Powāi Lake 30-11-34 (H. A.). Inverarity (*J.B.N.H.S.*, ii, 46—1887) saw large flocks at Neral below Matheran. One shot near Karjat.

Status? Probably local straggler. Rare.

The Lesser or **Common Whistling Teal** : *Dendrocygna javanica* (Horsf.).

Field identification : Smaller than the domestic duck. A chestnut coloured duck confusable with no other of the same size. Small flocks. Shrill whistling notes constantly uttered on the wing distinctive. Flight rather feeble and unducklike, reminiscent of the Jacanas.

Specimens : *B.N.H.S.* : o? 22-5-26 Mahadalla Tank, Malād (E. Henricks); [♂ 29-11-15 Kalyan (W. S. Millard)].

Noted : Powāi Lake, Irla; Kihim (Kolāba Dist.) on rocks on seashore! A flight of about 40 birds was seen at Hornby Vellārd on 6-11-38. They settled out in the bay well out of range, but passing the same way a couple of hours later, we saw a swimmer trying to retrieve two winged birds, and a man with a gun watching the proceedings. It may be an achievement to shoot wild duck in Bombay City, but unless some sanctuary is allowed to game birds (especially a resident species) we shall soon be exterminating them.

Resident? Uncommon and in small numbers. Possibly breeds around Powāi Lake.

The Sheldrake : *Tadorna tadorna* (Linn.).

Mr. C. McCann observed a small party on Tūlsi Lake some years ago. Other records from the Deccan show that this bird occasionally straggles further south.

The Ruddy Sheldrake or **Brahminy Duck** : *Casarca ferruginea* (Voeg.).

Hindustāni : *Chakwa.*

Field identification : Larger than the domestic duck. Orange brown with a shiny green patch on the predominatingly black and white wings. Head and neck buff. Pairs or small parties.

W. F. Sinclair (*J.B.N.H.S.*, i, 166) observed a pair in Bombay Harbour (ca. 1886). H. A. noted a party of 4 at a brackish pool on a tidal mudflat near Rewās (Kolāba Dist.) on 22-11-32.

Winter visitor. Straggler? It is common round Nasik and in the Deccan.

The Mallard : *Anas platyrhyncha* Linn.

Field identification : The ancestor of our domestic duck, equal to it in size and same in colouration as the green-headed plumage often seen. The female is dark brown with buff streaks producing a game bird pattern.

The only records of its occurrence we have are (1) that of E. H. Aitken (*J.B.N.H.S.*, xiii, 398) who says that owing to the severe drought in Gujerat and the Deccan a few were seen about Bombay in the winter of 1900 (2) Sinclair (*J.B.N.H.S.*, iii, 71) has recorded one from Nagotna in Dharamtar Creek (3) One was shot near Panvēl on 17 November (*J.B.N.H.S.*, xxix, 1052).

The Spot-bill or Grey Duck : *Anas poecilorhyncha poecilorhyncha* Forster.

Field identification : Size that of the domestic duck. Rather like the female Mallard in colouration with some white in the wings and two orange-red spots at base of bill on either side of forehead.

Specimen : *B.N.H.S.* : [o? 7-12-09 Daman Road, B.B. & C.I. Rly. (R. L. Sinclair).].

Straggler. Aitken (*J.B.N.H.S.*, xiii, 398) mentions the Spotbill occurring in or near Bombay in the winter of 1900 due to the drought in Gujerat and the Deccan. S. A. observed a party of 4 birds flying over Kihim (Kolāba Dist.) on 1-10-30.

The Gadwall : *Chaulelasmus streperus* (Linn.).

Field identification : Smaller than the domestic duck. General aspect of plumage pale brownish-grey with rufous head and neck. A black-and-white wing-bar particularly conspicuous in flight, and a chestnut patch on wing. Underside white. Female : mottled dark and light brown with whitish underparts and wing-bar as in male.

Specimens : *B.N.H.S.* : [♂ ♀ 26-12-09 Panvēl, Kolāba Dist. (N. B. Kinnear); ♀ 15-6-90 Alibāg (W. F. Sinclair).]

Noted and/ or shot : Andhēri, Chembūr ('kutchra-patti'), Trombay; Kihim

Winter visitor, in small numbers. Not uncommon. Of bags of 14 and 7 ducks made near Chembūr, two and three respectively were Gadwall.

The Wigeon : *Mareca penelope* (Linn.).

Field identification : Smaller than the domestic duck. General aspect pencilled grey. Chestnut head with cream coloured patch on its forepart, combined with the brownish-pink breast and the blue-grey bill suffices to identify the male. Female rather like the female Gadwall but lacks the wing-bar. The blue-grey bill is a diagnostic character in both sexes.

Specimen : *B.N.H.S.* : [♂ 26-12-09 Panvēl, Kolāba Dist. (N. B. Kinnear).]

Noted and/ or shot : Santa Cruz ; Kihim.

Winter visitor. Uncommon.

The Common Teal : *Nettion crecca crecca* (Linn.).

Field identification : Our second smallest duck, only slightly bigger than the Cotton Teal. Male : pencilled greyish colour. Chestnut head with a broad metallic green band running through the eye, lined on either side with whitish. A tri-coloured wing-bar—black, green and buff—especially conspicuous in flight. Female rather like female Gadwall with a metallic green and black wing-bar.

Specimen : *B.N.H.S.* : ♀ 7-10-24 Lamzai, near Kūrla (D. B. Baretto).

Noted and/ or shot ; Andhēri, Santa Cruz, Bassein, Thāna, Gōdhbunder, Tūlsi Lake ; Naugaon (Kolāba Dist.).

Winter visitor, in small numbers. Not uncommon.

The Pintail : *Dafila acuta* (Linn.).

Field identification : Slightly smaller than the domestic duck. Male ; upper plumage pencilled greyish. Head brown with a white band on either side running down into the white neck and underparts. Its chief characteristic is the long, pointed pin-like central tail feathers which extend beyond the tail. The elongated body, the long slender neck and pointed tail usually help to recognise the drake. Female : mottled brown and buff. In general rather like the females of the Gadwall and Wigeon but slenderer in build.

Specimens : *B.N.H.S.* : [♀ 26-12-09 Panvēl, Kolāba Dist. (N. B. Kinnear).]

Noted and/ or shot : Bassein (Thāna Dist.), Chembūr, Trombay ('Kutchra-patti'), Kihim.

Winter visitor in small numbers. H. A. has observed a small flock among the rocks on the seashore at Kihim (Kolāba Dist.).

The Garganey or **Blue-winged Teal** : *Querquedula querquedula* (Linn.).

Field identification : Slightly larger than the Common Teal. Male recognisable by his pink-brown white-speckled head with the broad conspicuous white eyebrow and by the bluish-grey on his wing shoulders. The female resembles the females of so many ducks of the same size that without some practice it is difficult to recognise her by herself.

Specimen : *B.N.H.S.* : ♂ 7-12-09 Daman Road, B.B. & C.I. Railway. (R. L. Sinclair).

Noted and/ or shot : Naugaon and Rewās (Kolāba Dist.).

Winter visitor. Not common.

The Shoveller : *Spatula clypeata* (Linn.).

Field identification : Somewhat smaller than the domestic duck. More characteristic than its plumage and unfailing as a recognition mark is its peculiar flat shovel-shaped bill, considerably broader at tip than at base. This is possessed by both sexes though they differ considerably in colouration.

Specimen : *B.N.H.S.* : ♂ 5-12-99 'Thāna' (purchased).

Noted and/ or shot : Trombay ('Kutchra-patti'), Rewās (Dharamtar Creek), Waklan (near Mumbra), Alibāg (Vaishwi Tank).

Winter visitor in small numbers. Not uncommon. Latest date 19 May.

The Red-headed Pochard or **Dun Bird** : *Nyroca ferina ferina* (Linn.).

Field identification : A squat duck, somewhat smaller than the domestic bird, recognisable by its rotund shape and the conspicuous tri-coloured plumage of the male—head chestnut ; breast, rump and hind parts black ; body pencilled grey. The female is predominantly dirty grey-brown.

Specimen : *B.N.H.S.* : ♀ 8-10-93 Bombay Harbour (W. S. Millard).

Noted and/ or shot : Bassein, Chembūr, Powāi Lake.

Winter visitor in small numbers. Not uncommon. Out of 2 bags of 7 and 14 duck, one and 2 respectively were of this species.

The White-eyed Pochard : *Nyroca rufa rufa* Linn.

Field identification : Smaller than the domestic duck. General aspect of plumage rufous-brown and blackish-brown with a whitish wing-bar. Abdomen white. Female duller coloured.

Specimen : *B.N.H.S.* : ♀ 17-11-08 Andhēri (N. B. Kinnear).

Noted and/ or shot : Kihim and Alibāg (Kolāba Dist.).

Winter visitor. Not uncommon as wildfowl go in our area. In the cold weather of 1931 we observed fairly large flocks floating on the sea not far from the shore (at Kihim) but always well out of gunshot. At dusk—often after it was quite dark—the birds regularly flighted inland in parties and in twos and threes taking the same route every evening. Similarly, W. F. Sinclair (*J.B.N.H.S.*, xiii, 191) writes: 'This is *the* sea duck of Alibāg Coast, where flocks not exceeding 50 were constantly to be observed in winter. They generally rode just outside the surf where they were safe from disturbance from passing boats. It is likely that they used the sea as refuge during the day and fed inland at night.'

The Scaup: *Nyroca marila marila* (Linn.).

Aberrant straggler. J. D. Inverarity (*J.B.N.H.S.*, ii, 45) shot a female on a small tank near Panvēl on 13-1-1884. No other record.

The Tufted Pochard: *Nyroca fuligula fuligula* (Linn.).

Field identification: Size and rotund shape of the Red-headed Pochard. Male black and white with a conspicuous black tuft at back of head of same colour. Female like male but brown where he is black and lacking the crest.

Specimen: *B.N.H.S.*: ♂ 5-12-99 Thāna.

Noted: Alibāg (Vaishwi Tank). Inverarity (*J.B.N.H.S.*, ii, 45) records it near Penn, Kolāba Dist., on 28-11-1887.

Winter visitor. Scarce. Latest date 14 March. Most duck visiting or passing over Bombay and the surrounding neighbourhood, take refuge on the sea during day time, and flight in to feed in the evening. Even the essentially fresh water duck like Wigeon and Pintail are often seen beyond the surf during the day.

The Goosander: *Mergus merganser merganser* Linn.

Aberrant straggler. E. H. Aitken (*J.B.N.H.S.*, ii, 56) shot one (either ♀ or immature ♂) on 2-12-1886 at Shewa on the east side of, and across Bombay Harbour. It was playing along in a shallow sheet of water forming a reservoir of the salt works. No other record.

The Little Grebe or **Dabchick**: *Podiceps ruficollis capensis* Salvadori.

Mahrātti: *Pān-būrki*.

Field identification: Size about that of the Pigeon. A drab coloured water bird with short pointed bill and practically no tail. Gregariously, on village tanks, etc. swimming about in open water or among the floating weeds, and diving at the least suspicion.

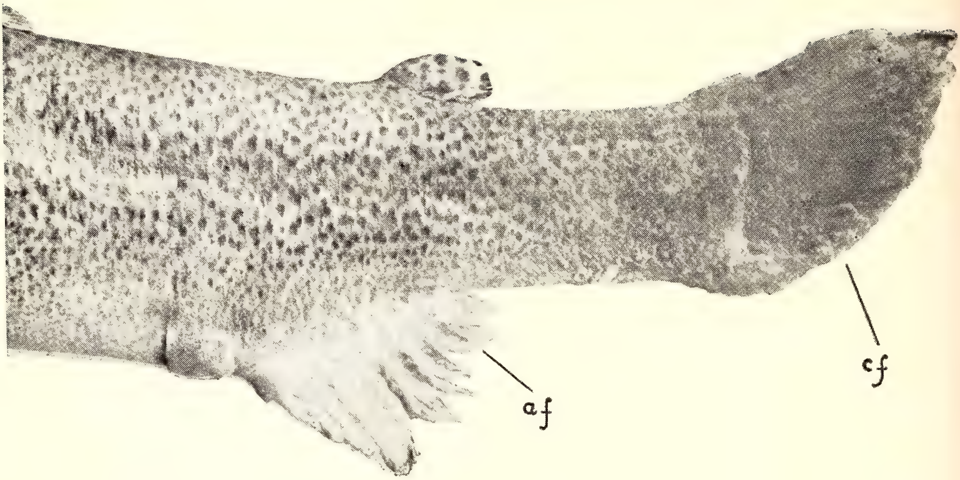
Specimens: *B.N.H.S.*: ♂ 12-3-93 Thāna (J. M. Mason); ♀ 19-11-17 Kūrla (S. H. Prater); ♂ 6-12-18 Colāba Cove, Bombay Harbour (J. A. D. McBain).

Noted: Dhobi Talao, Gwālia Tank and Babulla Tank (Mazagon) before they were filled up; Mahāluxmi, Parēl, Andhēri, Chembūr, Powāi Lake, etc.

Resident. Common. Present on practically every village tank and congregating on larger sheets of water as the former gradually dry up in the hot weather. Thus on Vaishwi Tank, which provides the water supply to Alibāg town, S. A. counted 132 individuals on 19 May (1930) when most of the smaller tanks in the neighbourhood were quite or almost dry. A couple of months previously the number of Dabchicks on this tank had been considerably smaller. The call is a sharp tittering often heard when the birds are disporting themselves of an evening. They can seldom be induced to fly. On taking alarm they either dive below or patter along the surface for some distance vibrating their diminutive wings rapidly. When once started on the wing, however, they fly well and often for considerable distances. Their food consists of water insects and their larvae, tadpoles and small crustaceans.

Breeding: The season is not sharply defined. H. A. found a nest in a mill pond at Mahaluxmi in September, and another on the village tank at Kihim (Kolāba Dist.) in October. Fry (*J.B.N.H.S.*, xxi, 275) took 3 clutches of eggs from the 'Mahaluxmi Pond' between 16 November and 31 March. On 22-11-34 H. A. observed a juvenile in downy striped plumage with red beak on Konkan Tank, not far from Mumbra (Thāna Dist.). The nest is a rough pad of sodden weeds placed on floating vegetation. A normal clutch consists of 3 to 5 eggs. These are white at first but soon get discoloured to dirty brownish by the constant soaking and contact wih the sodden weeds.

THE END.



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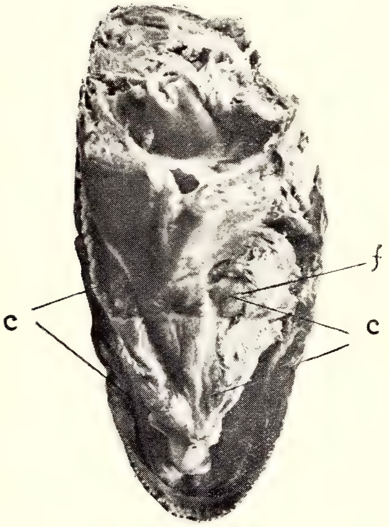

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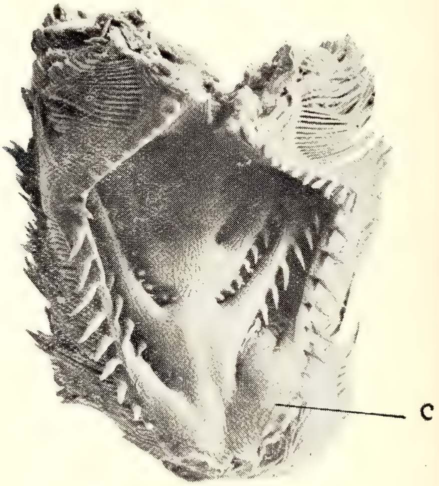

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Fig. 1.—Rainbow Trout showing Fin-rot on the caudal and anal fins. Stumpy caudal fin (*cf*) and frayed anal fin (*af*) are noteworthy.

Fig. 2.—Rainbow Trout with Carcinoma of Thyroid. Atrophied gill filaments (*f*) are seen attached to the tumours (*c*).

Fig. 3.—Brown Trout with Carcinoma of Thyroid (*c*).

NOTES ON THE DISEASES OF TROUT AT THE MAHILI HATCHERY—KULU (PUNJAB).

BY

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(*With a plate*).

Little attention has so far been given to the diseases of trout in its Indian habitats. The control of parasitic and other diseases is a problem of considerable importance. Under domestication, i.e. when herded together and fed on artificial food, trout, like all other animals, fall victims to parasites and contract diseases.

Gaschott (1931) has given an account of the various diseases, to which trout are susceptible, and has dealt with their diagnosis and treatment. Davis (1936) has dealt with internal and external parasites of trout and such other diseases as Fungus, Pop-eye, Thyroid tumour, Intestinal inflammation, White spot disease, Blue sac disease and Soft egg disease. Moore (1923, 1924) has made a study of diseases of fish in State Hatcheries in New York. Carcinoma of Thyroid in the Salmonoid Fish has received an exhaustive treatment in the well illustrated paper by Gaylord and Marsh (1914). Several other investigators, both in Europe and America, have made a study of the various parasites and diseases of trout and other fish and dealt with their control and treatment.

A systematic study of the diseases of trout, it is regretted, has not been made on account of lack of facilities, and in the present paper an account of such diseases as have come to our notice at the Punjab Government Trout Hatchery at Mahili (Kulu) is presented.

The diseased trout were obtained from the Hatchery and most of this material was received preserved in 5 per cent formalin. In a few cases alive sick fish were also examined. Of the two species, Rainbow Trout and Brown Trout cultivated at the Mahili Hatchery, the former has suffered far more acutely from parasites and other diseases than the latter.

The commoner diseases at the Mahili Hatchery have been Fin-rot, Carcinoma of Thyroid, Inflammation of Intestine, and Fungus.

Fin-rot or Tail-rot or Fin-disease was first noticed at the Hatchery in August 1929 among Rainbow Trout, and it appeared in an epidemic form. The diseased fish had grown sluggish and dark in colour. The dying fish came to the surface, gasped for air, turned upside down and after a few hours died. Both in the adult and in the fingerlings the caudal fin had lost its rays and had been reduced to a stump (Fig. 1). In most of the cases dorsal.

pectoral and anal fins had also been affected and showed naked fin rays without any covering of epidermis.[1]

Fin-rot is caused by a rod-shaped bacterium which can usually be found in large numbers in the infected fins (Davis 1936). The infection usually starts from the outer margin of the fin, where the epidermis becomes thickened and forms a white line, visible externally across the fin. The fin rays are also attacked and soon become frayed and broken. Sometimes only a portion of the fin is destroyed, and in other cases the outer half or two-thirds is destroyed.

The young fingerlings usually die before the infection has spread to the underlying tissues; while in the adults the tissues at the base of the fins are also affected. The disease varies greatly in its intensity. Among the fry the mortality is always heavy. Among adults recovery is possible though the fins retain their stumpy appearance. According to Davis (1936) 'the fins regenerate more or less completely'. No such regeneration of the fins, however, has so far been noticed among the fish which have recovered at the Mahili Hatchery.

According to Davis (1936) 'little information has been obtained regarding the factors that tend to bring an outbreak of the disease'. At the Mahili Hatchery, however, it has been definitely observed that fish and fry reared in clear spring water remain unaffected; while those reared in ponds fed by river water, which brings in silt during the floods, always suffer from an attack of Fin-rot soon after the monsoon rains. At Madhopur Farm, too, flood water in July was directly responsible for the outbreak of this disease among Rainbow Trout fry.

Control.—A salt bath instead of producing any healing effect, seemed to hasten the death of the sick fish at the hatchery. Davis (1936) recommends baths of a solution of copper sulphate, 1 : 2,000, for one or two minutes. But it is too strong a solution to be administered by unskilled hands either to adult fish or to fingerlings. A bath of 1 : 20,000 solution of copper sulphate for 10 to 15 minutes however, proved efficacious in early stages of the disease. The bath was repeated daily and healed the fins within a fortnight. The fish in which the disease had advanced did not survive. The warm water bath, recommended by Taplin (1932), proved beneficial during winter. The fish from the hatchery pond, where the range of temperature was 38°F. to 48°F., were transferred to a spring fed pond with a temperature ranging from 55°F. to 58°F. and were cured of the disease completely.

Carcinoma, Thyroid tumour or *Goitre* in trout is said to be analogous to goitre in man (Davis 1936). It is, therefore, interesting to note that in the Kangra District, where Mahili Trout Hatchery is located, human beings, too, suffer from goitre.

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[1] Dr. W. Rushton (Fishmongers Hall, London), to whom the diseased Rainbow Trout were sent for examination, reported that 'No external lesions could be found or any features, which point to, or suggest, that the fish had died from "furunculosis" . . .'

Note.—Furunculosis is another bacterial disease, the most characteristic symptom of which is the presence of open sores on the body (Davis 1936).

The disease has not so far been noticed in an epidemic form at the Hatchery. Only occasionally one or two fish have suffered. The tumours of thyroid, in the diseased fish examined (Figs. 2 and 3), were located at the junction of the first and second pair of gill arches, on either side, and also between the third and the fourth gill arches. The former pair of tumours were visible internally too, on the floor of the mouth. Atrophied gill filaments were seen attached to the tumours.

The primary cause of thyroid tumour is now generally considered to be a deficiency of iodine, which is essential to the proper functioning of the thyroid gland (Davis 1936). Overcrowding, a limited supply of water, and insanitary condition in the ponds also appear to be important contributing factors.

The diseased fish linger on for months and months, and it is only when the tumour has enlarged to such an extent that it has spread into the gill arches, that the blood vessels cease to function and in portions the circulation is stopped and the fish dies.

Control.—At the Mahili Hatchery the fish in which the disease was noticed in an advanced stage were always killed. In the early stages of the disease a weak bath of iodine (potassium iodide) in 1 : 1,000,000 strength has given satisfactory results, and the fish recovered. Gaylord and Marsh (1914) recommend the administration of the following chemical baths: iodine (potassium iodide) 1 : 1,000,000; arsenic (arsenic oxide) 1 : 3,000,000, and mercury (mercuric chloride) 1 : 5,000,000. Davis recommends (1936) addition of iodine directly to the food: a table-spoonful of 1 per cent iodine dissolved in 1 per cent solution of potassium iodide 'thoroughly mixed with about 50 pounds of ground food is sufficient to keep the fish from showing any trace of thyroid tumour'.

Intestinal Inflammation: Most of the Rainbow Trout attacked by Fin-rot at the Hatchery suffered from inflammation of the intestine as well. In 1929 when the epidemic of Fin-rot appeared, the fish, as an economical measure, were being fed on 75 per cent oat flour and 25 per cent dried fish. It was rather expecting too much from these carnivorous fish to maintain their vitality on such a poor diet. The diseased fish had grown dark in colour, refused to take any food and sought the corners of the pond. The intestine was inflamed and contained only mucus. One Brown Trout that died in February 1930 had a large tumour in the intestine which filled up the entire lumen.

The disease is apparently caused by unsuitable food. Change of diet, recourse to natural food, such as aquatic insect larvae, worms, snails, slugs and a large proportion of meat in their diet improves the condition of the fish.

Fungus or *Saprolegnia* has so far not caused any serious damage at the Hatchery. *Saprolegnia* readily attacks dead eggs, dead fry or any dead organic matter lying in the rearing or hatching boxes. Adults are attacked by the fungus when they have been handled roughly, especially after the stripping season. It appears as tuft of white threads—mycelial filaments—on any part of the fish after some physical injury, and its filaments soon spread into the underlying tissues.

Control.—A 3 per cent solution of common salt for 5 to 10 minutes or until fish show signs of distress, has so far proved very efficacious. Patches of skin overgrown with fungus, when rubbed gently with cotton soaked in a 1 : 2,000 copper sulphate solution or solution of common salt in vinegar or iodine, have effected speedy recovery. The most effective remedy to prevent an attack of fungus is to remove the root cause of the disease. Daily picking of dead eggs, cleaning all the troughs and hatching trays, regular salt baths for the fish, after they have been handled, have always proved effective against an attack of fungus.

The writer had an experience of a very striking example of *Saprolegnia* growth on Carp. In a Carp Farm in the Punjab the fish were confined to a portion of tank with a wire netting screen as a partition. Whenever fresh water was let into the tank, the fish rubbed their heads against the wire netting attempting to escape towards the inflowing current. They consequently received injuries on their lips, mouth and head, where fungus appeared in profusion and the fish began to die in large numbers. The wire netting screen was at once removed, the diseased fish were given salt baths and in a very short time recovered.

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NOTES ON BUTTERFLIES OF THE SHAN STATES, BURMA.

BY

Capt. W. C. Carrott.

I have recently been reading through the back numbers of the *Journal* from vol. x, 1895, and to my surprise I have not noticed any account or list of the butterflies of this very interesting part of Burma.

While I have not covered all of the Shan States during my fifteen years of collecting I think I may claim to have a fairly good representative collection of butterflies from this area.

The Shan States covers a large amount of the hilly country in Upper Burma. The highest elevation reaches about 6,000 feet above sea level. Both the Southern and Northern sections are reached either by rail or road. The railway terminates at Lashio in the North and Shwenyaung in the South. Beyond these railheads are fairly good second class roads up to the Chinese border. It is not advisable, however, to travel by car far beyond the railheads in the rainy season. In the dry season the roads are in good condition in so far as second class roads can be made good and one can motor through what I consider to be one of the most interesting countries in the world. The scenery is beautiful beyond description and the different tribes vary as does the scenery. The motorist passes through rolling downs, dense jungle and lovely pine woods with a lake dotted here and there in the course of one morning's drive.

In the *Identification of Indian Butterflies* the author, referring to Burma, says that 'in many ways the Thandaung ghat is one of the best collecting places in the Indian Empire; it is the meeting place of the Chinese and the Malayan elements and possesses a number of species or well defined races that do not appear to be found elsewhere.' This section referred to is on the same range of hills as the Shan States but geographically not in the Shan States.

I might go farther than the above-mentioned author and say that the whole of the Shan States is one of the best collecting grounds in the Indian Empire. I feel sure readers will agree when they notice the long list of butterflies to be found therein, many of which are very rare and not found elsewhere.

Maymyo, the writer's headquarters, while not in the Shan States proper is on the plateau at the beginning of the Northern section and is an excellent locality for many rare and interesting varieties. During my twelve years of residence here and eight at Kalaw in the Southern section, I have built up a good collection of butterflies from important places. In addition to Maymyo and Kalaw I have toured the States extensively and collected butterflies wherever I travelled.

Before giving the list of butterflies to be found in the Shan States I would mention I should be very glad to exchange with any collectors in India and Ceylon. I have many hundreds of duplicates and would be glad to get into touch with fellow collectors all over India especially Southern India and Ceylon.

The names given in the following list are taken from the 1st edition of the *Identification of Indian Butterflies* by Brigadier Evans, which I believe in some cases differ a little from the names given in the 2nd edition.

As I am not an expert there may be mistakes in the names especially in the Lycaenidae. This family together with the Hesperidae I find most difficult to name as there are so very many varieties.

PAPILIONIDÆ.

TROIDES

aeacus. Fairly common in all parts of the Shan States. Very fond of feeding on flowers of lantana.

helena cerberus. Common and as above. The variety *eumages* is very rare and I have only seen one male during the many years I have been collecting.

BYASA

aidoneus. Rare but if one knows the time of flight which is during September one can collect a few specimens in and around Maymyo. This year I caught four males and two females. The colour of the female given by Col. Evans is brown. Those caught by me are not in any way brown but a distinct slaty black.

zaleucus. Very rare in the Shan States. I have only seen two males during my 15 years of collecting, one in Kalaw in the South and the other at Maymyo in the North.

aristolochiae goniopeltis. Very common all over the country.

philoxenus polyeuctes. Fairly plentiful during May and September. Evidently it is double brooded as they are not seen between the above two months.

crassipes. Very rare indeed. I have only seen one from Kalaw in the South during my many years of collecting.

CHILASA

agestor agestor. I generally get half a dozen of these each summer during April. Evidently feeds on the camphor tree as I have caught a number round this tree in my garden. It is a good mimic of *Danais tytia tytia* and can easily be taken for it.

slateri marginata. I have not found this butterfly in the Shan States proper but it is found at the foot of the Thandaung ghat adjoining the Shan States.

clytia clytia. Common all over the country.

clytia onpape. Also fairly common especially in the North beyond Lashio and up to the Chinese border.

PAPILIO

[illegible]

memnon agenor. Males of this variety are to be found eight months of the year. Females however of all three forms are scarce.

westw.

rhetenor. Rare. I have only one in my collection; a female caught on 11-5-35 at Maymyo.

protenor euprotenor. Very rare in the Shan States but common in other parts of Upper Burma.

bianor gladiator. Found at Kalaw in the South only this year. During my eight years' residence there I did not see a single specimen. In September of this year a friend caught several in his garden. It may be I had taken it for *paris* as it flies with it and looks very much like it on the wing.

polyctor ganesa. Doubl. Fairly plentiful at Kalaw in the South but I have not found it in the North. This flies also with *paris paris* and is difficult to tell from it on the wing.

paris paris. Linn. Very common all over the country. I noticed the specimens taken from the Shan States are much larger than those I have seen in other parts of Burma and those from India.

arcturus arcturus. Westw. Rare in the Shan States.

mahadeva. Moore Rare, does not appear to fly about 2,000 feet and is found at Nan-Pan-Det at the foot of the Kalaw Hills and at low altitudes round about Taungoo towards the Karen Hills.

castor castor. Westw. Rare. Also does not appear to fly above 2,000 feet. I have caught it at Lebin in the South Shan States. Males are filth eaters and can be found feeding on excreta of animals.

helenus helenus. Linn. Common all over the Shan States.

chaon chaon. Westw. Also very common especially at Maymyo.

noblei. I have heard that this is found in the Shan States but have not come across it. I understand it is more common in the North of Burma around Myitkyina.

polytes romulus. Cram. One of our commonest butterflies. I have not come across the 3rd form of female, the one like *hector*. The other two female forms are fairly common.

demoleus demoleus. Linn. Very common everywhere.

✓ **machaon verityi.** Fairly plentiful in the Southern Shan States but rare in the North. It appears to fly at 5,000 feet and above. I have caught them at Kalaw and Taunggyi and I understand they are fairly common at a place called Pindaya.

xuthus. Linn. I have not heard of this being found in the Shan States but it may be found in the South towards the Chinese and Siamese borders.

PATHYSA

glycerion. Gray I have only caught one male of this in the Shan States although it is fairly common on the plains of Upper Burma.

agetes agetes. Westw. Rare at altitudes of above 2,000. More common at the foot of the hills.

nomius swinhoei. Wall. Common at between two and three thousand feet. Males can be found by the hundreds taking moisture from the beds of streams. Females are fairly difficult to get.

aristeus hermocrates. [illegible] Flies with the above and not distinguishable from *swinhoei* until one has it in the net. Fairly common.

antiphates pompilius. Fab. Common at low altitudes. Very rarely seen above 3,000 feet.

ZETIDES

cloanthus. Westw. Rare in the Shan States. Caught one in Kalaw some years ago but seen none since.

sarpedon sarpedon Linn. Very common all over the country and most parts of the year.

doson axion. [illegible] Fairly plentiful all over the country. Flies along with *s. sarpedon.*

eurypylus cheronus. Plentiful, especially during April and May in the hills.

bathycles chiron Common and flies with the former three varieties.

agammemnon agammemnon. Common but not so plentiful as the above four.

PARANTICOPSIS

macareus gyndes. Males are fairly common during April and May. Feed on moisture in stream beds and easily caught. Females appear to be rare.

xenocles kephisos. Not at all common. Fly during April and May and like *agestor* appear to feed on camphor trees. I generally collect about two pairs of this each year. Evidently single brooded.

megarus similis. I have caught males of this at 2,000 feet on the hills to Maymyo. No females caught as yet, but no doubt they could be found by getting into the jungle off the roadside where the males are found. Like others of this family the males are fond of moisture on roads and stream beds.

MEANDRUSA

gyas aribbas. A very rare butterfly. I secured a male in Kalaw at 4,500 feet during the summer of 1923. Commoner at 6,000 feet near Mogok.

payeni amphis. I have not seen this butterfly in the Shan States but believe it is to be found at Mogok 6,000 feet along with the above *gyas*.

TEINOPALPUS

imperialis imperatrix. There is one place only in Burma where this beautiful butterfly is to be found and that is at Thandaung, Karen Hills, adjoining the Southern Shan States. Evans says in his *Identification*, N. Burma to Ataran. The late Mr. Cooper said he saw a wing of one in the Ataran but I don't think this is sufficient proof to say they are to be found there. I have not heard of any of these butterflies being caught outside of Thandaung, on the hill there known as Thandaunggyi. The butterflies are very difficult to catch and fly very early in the morning between 7 and 10 o'clock. After that time they seem to disappear down in the valleys. Perhaps if one followed them down to the valleys they could be beaten up. Mr. Sparks of the Burma Railways informed me he has caught as many as half a dozen in one morning. I doubt if this number could be seen now apart from caught in one morning. They fly during April. I propose going up there next April to try my luck and if possible shall follow them down to the valleys when they disappear at about 10 a.m.

LEPTOCIRCUS

curius. Common at low altitudes but I have not seen them at above 3,000 feet.

meges indistincta. Common and as above.

PIERIDÆ.

LEPTOSIA

nina nina. Not at all common in the Shan States. One sees an occasional one during April and May.

PIERIS

napi montana. Not too plentiful. I have not seen any in the Northern Shan States but have seen odd ones at Kalaw in the South.

canidia indica. Very common all over the country.

brassicae, Common in Maymyo in the summer months. I noticed this is not listed as being found in Burma.

APORIA

agathon agathon. Rare. I have only seen this in the South Shan States.

DELIAS

singhapura agostina. Fairly plentiful all over the country.

eucharis. Common both South and North.

hyparete hierte. Fairly plentiful at different times of the year.

belladonna burmana. Rare. I only collected one of this from the South, Kalaw, many years ago. Seen none in the North.

descombesi leucacantha. Not rare and can be found most all over the country.

aglaia. Common during summer months.

thysbe pyramus. Very common around Maymyo in the North and not scarce in the South.

PRIONERIS

thestylis. Rare. Only found one male at Kalaw many years ago.

clemanthe. Rare. Not seen in the North, odd specimens found at Kalaw in the South.

HUPHINA

lea. Not at all common in the Shan States. Can be found more plentifully at low elevations.

nerissa dapha. Rare at high altitudes. More plentiful at foot of hills.

APPIAS

lalassis. Rare in the South but not found in the North by me.

lalage lalage. Not too plentiful in any part of the country.

libythea olferna. Rare and I have not found this fly at higher than 3,000 feet.

lyncida hippoides. Common at low altitudes.

albina darada. Common at low altitudes, rare higher up.

paulina adamsoni. Very seldom seen it in the Shan States.

nero galba. I caught a couple of these in the Katha District not far from the Shan States but evidently it prefers the plains and does not fly to higher altitudes.

CATOPSILIA

crocale. Common all over the country and most of the year.

pomona. Common.

pyranthe minna. Common.

florella gnoma. Common.

GANDACA

harina burmana. Rather scarce, an occasional one can be seen in the summer months.

DERCAS

verhuelli doubledayi. Maymyo seems to be the headquarters of this butterfly as it is exceedingly common about six months of the year.

GONEPTERYX

rhamni nepalensis While Maymyo is the headquarters of the above, Taunggyi in the S.S.S. would appear to be the home of this butterfly. Hundreds of males are to be seen on the hills feeding on duranta flowers. Females however are very scarce.

TERIAS

libythea. Common.

laeta. Ditto.

blanda silhetana. Common but not so numerous as the above two.

hecabe hecabe. Very common.

COLIAS

None of this family in the Shan States; but I understand *croceus fieldii* is to be found in N. Burma. However, I have not come across it during my various tours in Upper Burma so I should think it either very local or rare.

IXIAS

pyrene latifasciata. Common at below 3,000 feet but very seldom seen at above this altitude.

HEBOMOIA

glaucippe glaucippe. Common at low altitudes but rather scarce at 4,000 and above.

PARERONIA

avatar avatar Not too plentiful in the Shan States.

valeria hippia. Fairly common in the South but not too common in the North. The variety *philomela* is very rare and I have not seen it in the Shan States but have caught it on the plains of Lower Burma.

DANAIDÆ.

HESTIA

lynceus hadeni. While this is not found in the Shan States I would mention that it is fairly common in the Myaungmya District in Lower Burma. Bassein is given in the *Identification* by Evans but I think this is misleading. During my trips to Bassein especially for this butterfly I never came across a single one. On the other hand a friend living in the Myaungmya District sent me several good specimens and said it was plentiful there. I should think it flies only within a radius of 50 miles, and so is very local.

aglea melanoides. Common all over the Shan States.

melaneus plateniston. Fairly plentiful but not so common as the above.

tytia tytia. Quite a number can be caught during six months of the year. April to September.

limniace mutina. Very common all over the country.

melissa septentrionis. Common and flies with the above.

gautama gautama. I have not come across this in the Shan States.

plexippus. Very common indeed.

chrysippus. Ditto.

EUPLOEA

mulciber mulciber. Very common.

alcathoe doubledayi. Rare in the Shan States. I have only caught one male during a long period of collecting.

alcathoe oesatia. Rare. One female only in my collection.

diocletiana diocletiana. Common at the foot of the hills but very seldom seen at above 2,000 feet.

klugii macclellandi. Rare in the Shan States.

klugi crassa. Butl. Rare in the Shan States.

midamus splendens. Butl. Very seldom seen in the Shan States.

midamus brahma. I have not come across this as yet not even in the Karens. It is probably very local.

godarte. Very common all over the country and at all altitudes.

deione deione. Rare in the Shan States proper but not so at the foot of the Karen Hills.

harrisi hopei. Very seldom seen; but I understand it is to be found up towards Lashio in the North.

SATYRIDÆ.

This is a family that I have not been able to do much with. In my early days as a collector I was not interested in the common browns. When I did get an interest I found my cabinets were too full to allow room for *Mycalesis*. However I have a few noted which I give below but which is nothing like a complete list of this butterfly found in the Shan States. At a later date I hope to be able to compile a more representative list.

MYCALESIS

francisca.

gotama charaka.

perseus blasius.

mineus mineus. Linn

visala neovisala.

suavolens.

nicotia.

mamerta mamerta. Cram

LETHE

sidonis sidonis. Hew. Not at all common in the Shan States. One male only in my collection.

sura. Not common in the Shan States but more plentiful in Northern Burma towards the Chinese frontier.

europa niladana. Quite common all over the country.

rohria rohria. Common.

confusa gambara. Very common indeed all over the country and at all altitudes.

verma stenopa. Common in and around Maymyo. I have not noticed it in the South.

latiaris. Hew. Rare. One male only in my collection.

mekara zuchara. Not common at high altitudes.

chandica flamona. Rare. Only one male caught by me.

distans. Not too rare. A few specimens caught by me. The few specimens I have caught have been in my garden in Maymyo in the middle of Cantonments.

vindhya. Rare, only one male caught by me.

kansa. Common, especially in the North.

sinorix. Hew. Rare. One female only in my collection.

pulaha pulahoides. Rare. One male only secured by me.

bhadra. Very rare. I have only seen one of these in the Shan States and that was at Kalaw in company with Dr. Haynes when we both did a scramble for this prize which luckily fell to me.

muirheadi bhima. Rare and only at lower altitudes.

ORINOMA

damaris. It used to be fairly common at Kalaw in the South and I had not noticed it in the North before this year during September when I caught six males. I had been over the same ground every year and the same month for the last twelve years but never saw it before this year. I did not come across any females.

YPTHIMA

hubneri hubneri. Common.

baldus baldus. Very common.

savara. Not common in the Shan States.

sakra austeni. Common at foot of Karen Hills.

ZIPOETIS

scylax. I have only found one male during my many years of collecting and I should call it rare in this part of Burma.

ORSOTRIOENA

medus medus. Very common indeed.

ERITES

I have not come across any of these although I notice they are listed as found in the Shan States.

NEORINA

westwoodi. One specimen, male, only from the foot of the Shan States near Mogok.

ANADEBIS

himachala. I found plenty of this at the bottom of the Goteik Bridge in the North. It was quite common there. Not seen elsewhere. Perhaps very local.

diademoides. One male caught only at the foot of the Karen Hills near Taungoo.

MELANITIS

leda ismene. Very common all over the Shan States. Very variable on the underside.

zitenius zitenius. Not rare in and around Maymyo. Flies with the above.

ELYMNIAS

hypermnestra undularis. Common in the North.

nesoea timandra. One specimen only from Kalaw in the South.

AMATHUSIIDÆ.

AEMONA

lena. Caught a few in Kalaw. Appeared to be very local.

lena haynei. Common near Maymyo and very variable. I don't find any difference in the sexes except that the female is much larger than the male. It is double brooded and flies during April and September.

FAUNIS

arcesilaus. Not found at high altitudes. Very common at foot of hills.

STICOPTHALMA

louisa tytleri. This large butterfly is also found at the foot of the hills. Rare in the Shan States.

louisa louisa. Fairly common at the foot of the Karen Hills. I have not noticed it higher up in the Shan States proper.

THAUMANTIS

diores. Rare in the Shan States. One male only sent me from Momeik State near Mogok.

THAURIA

lathyi amplifascia. Fairly common in Maymyo but very local. Double brooded May and September. Unless one is on the spot when this emerges it is difficult to get perfect specimens. They fly so low and slow that they are the prey of birds and reptiles.

aliris pseudaliris. Common at the foot of the Karen Hills. Very rare in other parts.

AMATHUSIA

phidippus friderici. Very rare and only found at the foot of the Karen Hills. One damaged male only in my collection.

AMATHUXIDIA

amythaon. I have found this also at the foot of the Karen Hills and in no other part of the Shan States. Very difficult to get perfect specimens no doubt owing to its great size.

ZEUXIDIA

amethytus masoni. This is another butterfly of this large family that is found only at the foot of the Karen Hills. It would appear that Pathichaung where these butterflies are caught is the home of the *Amathusiidae.*

DISCOPHORA

tullia zal. Very common all over the Shan States. The variety *spiloptera* is very rare and I have not been fortunate in getting this. The other variety *indica* is not so rare.

continentalis continentalis. Nothing near so common as the above. Only one male in my collection.

ENISPE

euthymius. Rare in the Shan States but common at the foot of the hills. A number of these were sent me from the Upper Chindwin District and are apparently very common there.

(*To be continued*).

BIRD PHOTOGRAPHY IN INDIA.

BY

MAJOR R. S. P. BATES, M.B.O.U.

(*With* 6 *plates*).

It has been suggested that I should write an article for the *Journal* on how I get my photographs of Indian Birds, giving all relevant details of cameras, lenses, exposures, distances from the subject, hides, and apparatus and methods generally. This I will endeavour to do, but be it remembered that in India there are as yet far too few bird photographers, and in a country of this size our paths seldom seem to cross. My methods therefore are methods evolved largely from my own experience and may consequently be in a number of respects as antiquated as parts of my apparatus.

With the rapid evolution of miniature and small cameras, the continual speeding up of emulsions, the introduction of fine-grain developers, and the increasing popularity of colour photography, methods in all branches of photography are bound to undergo almost perpetual modification if not indeed considerable alteration. I do however venture to assert that the methods of the bird photographer have not altered appreciably but that these modern improvements have merely rendered their application easier. In other words, once you get your bird where you want it, nowadays, with any luck at all, you should be able to take a successful picture of it under almost any conditions of terrain and climate.

To generalize, bird photographs can be obtained in four ways:

(1) From the hide.

(2) By concealing the camera and releasing its shutter from a distance by electrical or other means.

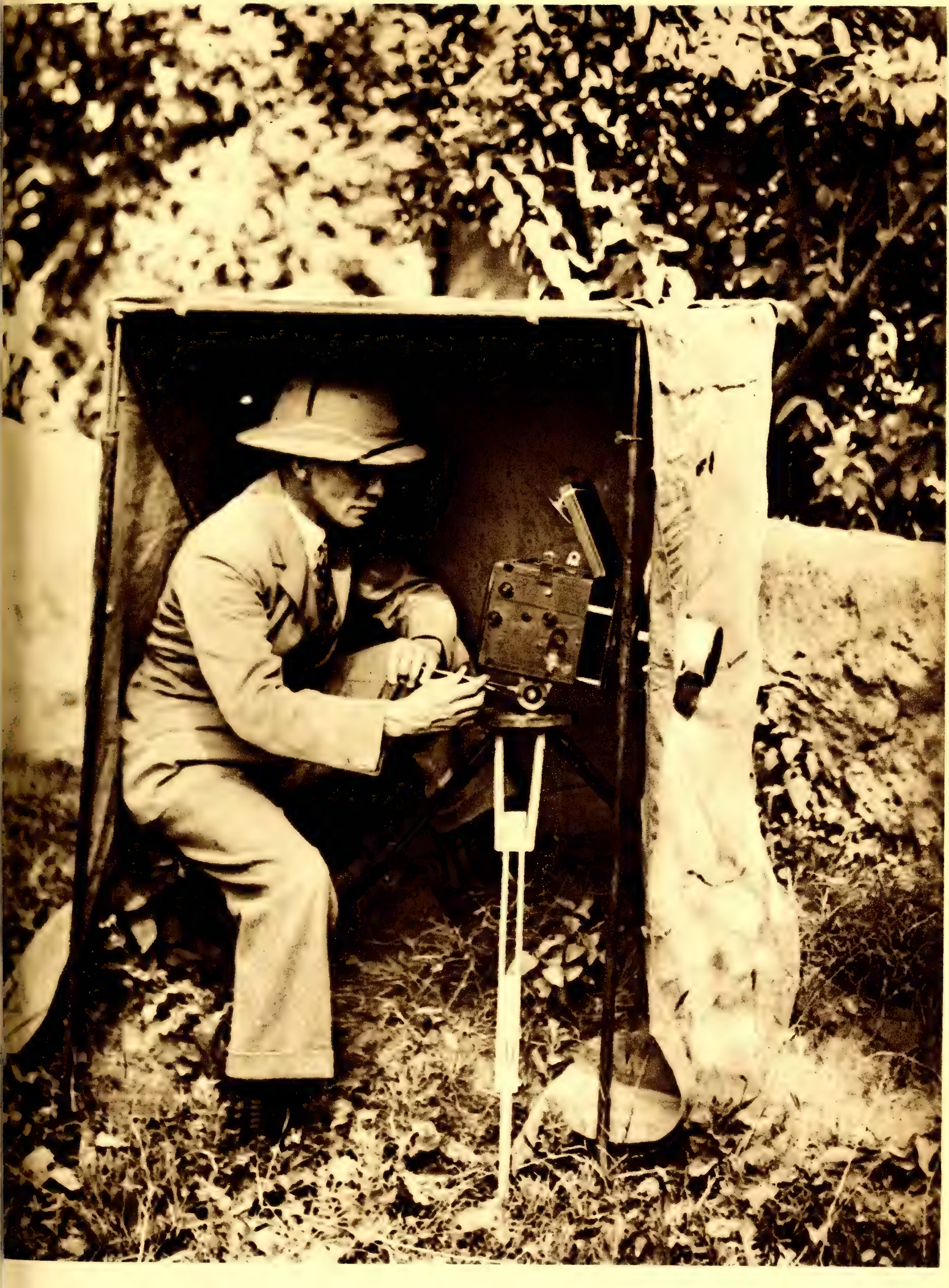
(3) By stalking.

(4) By flashlight.

Of flashlight photography I am quite ignorant, and have never even attempted it, so on that subject I have exactly nothing to say.

Stalking is generally, to put it vulgarly, a mug's game. By that I do not mean to imply that it should not be attempted at all. I have seen some excellent photographs achieved by stalking, but to walk about the countryside with a reflex camera at the ready and an eye on every bird you see sitting on a bush is a complete waste of both time and energy.

But, and it is a big but, there is one division of the breeding birds of this country to the obtaining of whose photographs the stalking method can be most successfully applied. Practically every negative I possess of Herons, Egrets, Storks, Cormorants, Spoonbills, and Ibises, and I have a few hundred, were taken paddling myself about their breeding grounds in a boat with a reflex between my knees, gradually on successive visits accustoming the birds to my presence until I was able to work up the boat, or let it drift



The Hide, uncamouflaged and with one side raised to show its construction. It is pitched on a sloping bank.

on a favourable breeze, close up to the subject I wanted. These birds have a habit of breeding in colonies; colonies sometimes of great size and complexity, containing every one of the species enumerated. When the trees they use stand in a village or on dry land, the nests for safety's sake will be confined to the summits of the tallest, but where they stand in water, nests may be quite low down from a few inches above its surface up to the crests of the half-submerged trees.

Two points of great importance emerge above all others in this work: the boat must be easy to manœuvre but stable so that noisy or jerky movements can be avoided; and the camera, preferably a reflex, should be capable of accommodating a lens of comparatively long focus. For years I have used a 12 inch focus Dallmeyer Tele-anastigmat. I have heard of longer focus lenses being used on birds and animals, such as those of 17 inch focal length, but the danger of getting blurred images through camera shake and movement is much increased, and very large images from which direct prints can be made are by no means a necessity.

I have not laid down the reflex as being the one and only type of camera for this purpose as the rangefinder-coupled small camera obviously has great possibilities but I have as yet had no chance of trying one out in a Heronry. The first boat I used, a light canoe, was definitely unsuitable, and after very nearly precipitating myself and my camera into the water I had to abandon all thoughts of climbing from it into the trees or taking photographs standing up to obtain a higher viewpoint. The rather broad collapsible punt evolved later proved much more useful. The illustration of the Openbills was taken from it. Big enlargements from this negative show no signs of camera shake or movement whatsoever and although stalked these birds very definitely are not in the least afraid. On the contrary, they are entirely engrossed in their own affairs.

I cannot remember how far distant I was from these Openbills but not more than 25 feet and probably less. The images on the negative are approximately half an inch in height. I remember on one occasion in this same Heronry a kindly breeze wafting me imperceptibly towards a Spoonbill until I was so close to the old gentleman that I could have prodded him with the end of the paddle. It was impossible to include all of him on the plate and eventually I found his head and neck taking up the whole of the focussing screen.

As for stalking what might be termed land birds, I have always found it extremely difficult, except on occasions in the case of nesting birds which rely for protection on immobility and obliterative colour pattern,—such for instance as Nightjars and Sandgrouse. Most birds seem to have an uncanny intuition and take to flight in that split second in which the photographer decides it is time to expose his plate. Actually what happens is that you stop or slow up for a fraction of time to press the release and the already suspicious bird is off the mark quicker than you are. And with that profound statement I think we will leave stalking to look after itself.

The other two methods have of course a great deal in common, but to my mind you miss more than half the fun by merely camouflaging the camera close to a bird's nest when you might just as well conceal yourself along with the camera. One of the greatest joys of bird photography from the hide is that you have the chance of studying a bird and its habits at the closest range. When it is most surprising how very different a bird looks really near engaged in its normal day's work. The texture of every feather, the intricacies of its colour pattern, its little idiosyncrasies and habits, become apparent; whereas at the distances you normally look at birds in your daily rambles, only their general ways and appearance are discernible.

Another great disadvantage in concealing the camera only is the necessity of approaching it and so disturbing the bird after every exposure. And a bird which is continually interrupted during incubation or in its visits to the nest with food and material is not likely to act in a normal manner for long. No, all things considered, photographs taken from the hide are bound to be the most satisfying both to the taker and the viewer, and also the least upsetting to the bird if due care be exercised.

I wonder if I might digress for a moment to get a grouse off my chest. If there is one type of photograph which I abhor, it is the type not infrequently seen in the daily press of some half-fledged terrified young bird with its useless toes at all angles obviously on the point of falling off the perch to which it has been made to adhere through sheer fright. Such photographs are in reality nothing but unnatural fakes. Yet apparently there are people who see something in such misleading pictures. By no stretch of the imagination can they be termed nature pictures anyway. In fact I cannot imagine anyone taking up bird photography seriously ever producing such worthless stuff. True bird photography is the art of portraying birds and their lives as they live them, so young birds incapable of leaving their nests should not be taken out of them to produce improbable photographs.

The less the contents of a nest are interfered with the better. Young ones I never touch, and eggs only when I am taking a nest and egg photograph. Then in deep nests I push the eggs towards the back of the cup inserting a pebble or short twig to keep them there. To tilt a nest to show its contents is a great mistake and straightway introduces an unnatural look into the picture. It is the camera which should be tilted, never the nest. Besides, pulling the nest about may lead to desertion. And if a bird deserts a nest upon which I am working, I consider a very black mark has been chalked up against me.

As an instance of where a distant release would have proved useful, here is an amusing incident which happened to me this year when photographing a Brooks' Nuthatch. With the hide scarcely 7 feet from the old Woodpecker's hole which they had cemented up until its entrance might just have accommodated a halfpenny, I had obtained half a dozen negatives with very little trouble. On development I was dissatisfied with the lot, so the following day I went back to try my luck again. The birds were

now so tame that they actually visited the nest while I stood motionless on the very spot on which I intended to erect the tent. I therefore put up the camera as close to the hole as I could and retreated some thirty yards to see results. Both birds made disagreeable noises from the next pine tree so after a short time I decorated the camera with hazel twigs. This move immediately had the desired effect, and the huge lens was ignored. But I had no distant release so took up my position just behind the camera. This obviously met with disapproval so my wife proceeded to stuff leafy twigs into my hat, down my neck, into my pockets, the tops of my stockings; in short she made me thoroughly uncomfortable. Every time I moved I rustled like a rattlesnake and shed bits of foliage. Nevertheless by the time I gave up trying to balance most of a bush on a large prominence accentuated by my stooping posture, I had obtained the pictures I required. It was an interesting experiment, but the day's work would have been accomplished more comfortably and just as quickly from my tent. And this at last brings us to photography from the hide.

In the first place what is meant by a hide? Every bird photographer probably has his own ideas on the subject. Some seem to consider a wigwam affair of a drab-coloured sheet thrown over a few sticks tied together at the top to be sufficient. In England where the photographer is most likely to be his own porter, such a sketchy affair may be indicated, but personally I put down comfort in the hide to be one of the first essentials. Nothing can be more tiring and disheartening, and consequently conducive of bad work, than sitting hunched up in a cramped position unable to move without fear of bumping into the sides of the tent, particularly on a sticky day in the monsoon. Remember that birds resent movement much more than they do noise so the tent must be roomy enough to permit a certain amount of freedom. This does not mean that it must be large, but it should be so constructed that it retains its symmetrical shape when erected on the most sloping and uneven ground, or anchored in a tree. Not only will such construction be conducive to comfort but the possibility of frightening away the bird through inadvertently sticking a knee or an elbow into a portion of the tent wall which you had not realized to be so close, will be greatly minimized.

I described my original tent in *Bird Life in India*. My present one is a great improvement upon it and is constructed as follows. I bought four lengths of $\frac{3}{4}$ inch iron piping (as used for encasing electric wiring) each four feet long and had 2 inch spikes fixed into one end of each. The bore of this piping is such that $\frac{1}{2}$ inch diameter brass covered curtain rod slides into it very comfortably. These tubular curtain rods can be bought in any bazaar at about 2 annas a foot and are extremely light. On to these are fitted collars provided with a wing nut by which the amount of rod protruding from the iron piping may be easily adjusted. So much for the legs of the framework.

The top consists of three more lengths of the iron piping, two being side pieces 2 ft. 9 in. long, and the third, one of the ends, 2 ft. 2 in. in length. These rods are threaded at both ends to screw into three-way angle pieces, the down-pointing socket of the three being to accommodate the top of a leg. The fourth rod, to complete the rectangle, is a wooden unthreaded one which fits easily into place in its sockets by slightly forcing the side bars apart. When complete the roof frame measures 3 ft. by 2 ft. 6 in. The tent therefore is 3 ft. long by 2 ft. 6 in. wide and adjustable in height from 4 ft. up to more than 7 ft. Not that I have ever had occasion to use it so attenuated, as firstly six or eight inches of the legs will probably be embedded in the earth, in marshy or sandy ground perhaps a good 2 ft. Secondly the excessive permissible length of each leg is to allow of the roof remaining level when the tent is pitched on an abrupt slope, where the outer legs of course have to be considerably longer than the upper ones. If the roof is not kept level with the tent walls vertical then you are in for trouble with the drill cover which will not 'hang' but ruckles up and cannot be clipped together without gaps forming at the upper corners of the tent.

I once threw away a good chance of photographing a Chukar through neglecting to check up on this point. I had waited patiently for nearly two hours while both the birds cackled incessantly from amongst some rocks fifty yards above the hide. At length complete silence reigned as a pair of hawks responsible for the disturbance betook themselves further afield. A few minutes later I turned to look through a peep-hole in the side of the tent at the same time raising my hand. With a startling whirr of wings and much abusive language a Chukar hurtled down the hill side. It had been within a few feet of the back of the tent paddling along the goat track which led straight past the nest and had obviously seen my hand through the gap a few inches wide which I had failed to notice.

I consider it necessary to have the cover rather tight fitting so that it cannot flap about in a high wind. The last time I was at home I saw a photographer working upon a Golden Plover's nest on a Yorkshire moor. His tent was almost white, or appeared so against the dark heather; its sides were so loose that in the blustery wind then blowing they were flapping in and out with considerable force, and lastly there had been no attempt at camouflaging this tent so alien in its sombre surroundings. Some distance away I picked out the disconsolate Plover making no attempt whatsoever to go near its nest.

An added disadvantage of loose tent walls comes to light in this question of camouflage. If the cloth can blow about in a wind, not only may the bird be frightened away but grass, leafy branches, and other materials used for concealment, are apt to be dislodged.

The fabric of my tent consists of khaki drill, a rectangular strip 3 ft. by 2½ ft. forming the top on to which the sides and ends each 4½ ft. in length are stitched. Inside the top are 8 tabs which clip round the bars of the roof frame with large press studs to keep the roof taught. At one time I had a flap in this roof which I could turn back for ventilation. The first time it rained I got a stream of water on my head and into the focussing hood of the reflex. I now depend on the fresh air which gets in at the edges.

Each of the sides has an overlap of 2 inches and on this overlap are large press studs at 8 inch intervals. Across the roof and on all four sides about a foot apart are thin ropes caught to the drill at intervals. Into the loops thus formed the camouflaging material can be stuffed with a good chance of its remaining in place.

For peep-holes I am afraid I mutilate the walls with a pen-knife. Specially prepared holes always seem to be in the wrong place, but after a few short slits have been made here and there, one or other will turn out to be right and the mutilation may cease. Some photographers, I believe, use a periscope, but I have never availed myself of this device, perhaps to my loss.

For the lens apertures I have found Zipp fasteners most useful. In the front panel I have two, each a foot long opening up and down from the centre. I have now added long ones in each of the side panels since finding myself incapable of dealing with a Himalayan Pied Kingfisher which contented itself with sitting on guard 8 feet to the left of the tent, never once flying up to the nest-hole upon which I had trained the lens.

I always carry four short iron pegs and a length of rope wrapped up in the tent in case the ground should prove too hard to drive in the legs and for use when the tent has to be raised from the ground in a tree or on a platform. For local use I also substitute $\frac{5}{8}$ inch curtain rods for the iron ones as the latter are so much heavier. I prefer however to take the stronger legs when out on trek to avoid any possibility of a breakdown.

Unfortunately birds seem to have an absolute flair for putting their nests in awkward situations. On occasion the only possible advice is 'find another nest', but if time permits and the necessary materials are procurable, the majority of nests can be dealt with. Ground-breeding birds of course prove the easiest victims, although in reed-beds and even on marshy ground it may be necessary to sink four posts into the mud and lash on to them just above water-level a plank platform on which to erect the tent. I have used a boat on occasion in deep water but the slightest movement is apt to make a boat sway; so a fixed platform is definitely preferable. It is when we come up against birds which nest in tall trees and on ledges on cliff faces that real difficulties crop up. A nest in a pine tree for instance is likely to be particularly difficult to cope with, as a thousand to one no position for the tent exists at the requisite distance.

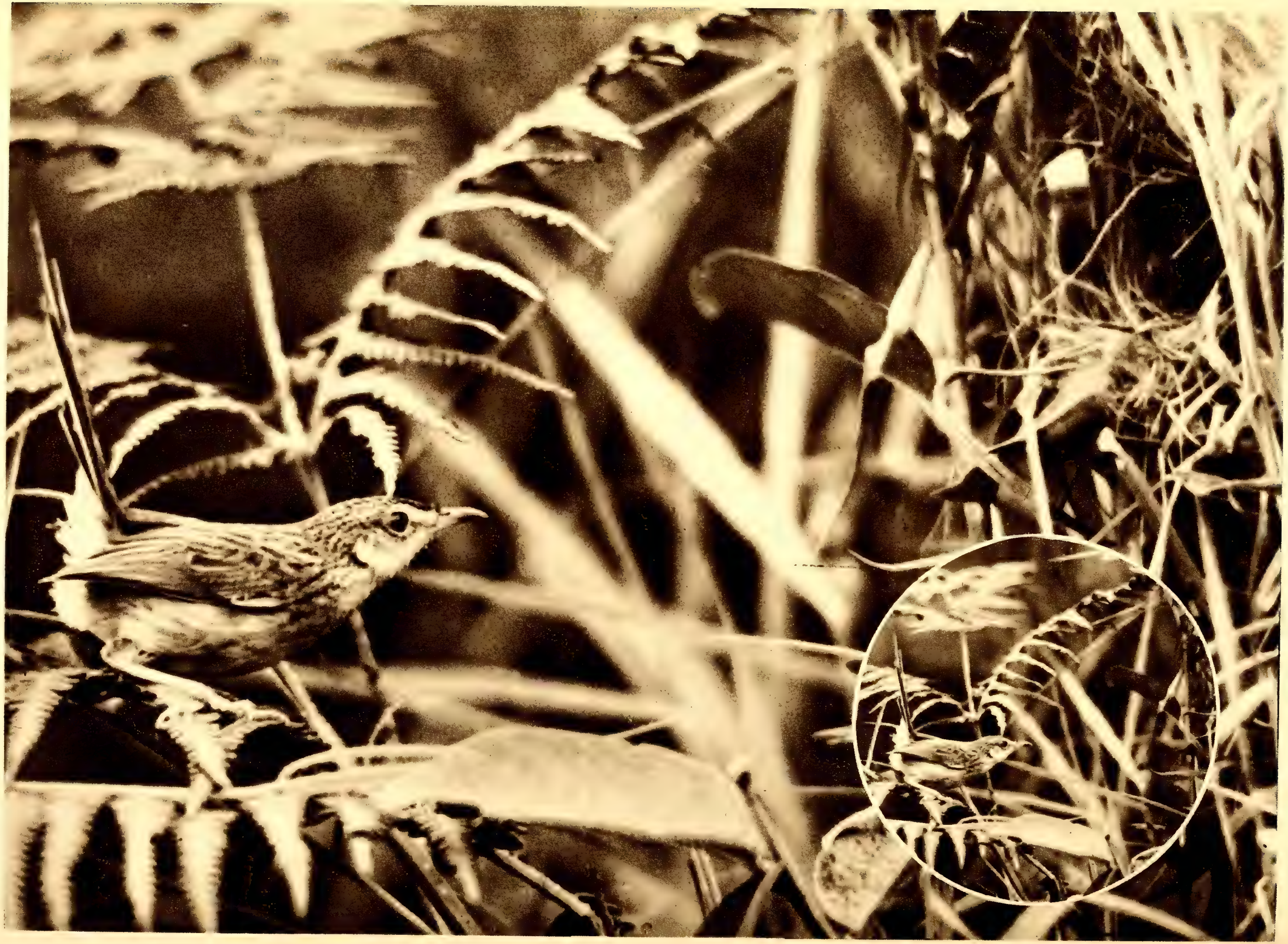
In dealing with a Blue Magpie's nest, which was approximately 30 feet from the ground in an attenuated maple, I once had to transport five 35 ft. pines from where they were lying two miles away in the debris of an avalanche and sink each one well into the ground in order to form a scaffolding for the tent 15 ft. from the maple. Incidentally I also moved my camp back three miles to be on the scene of action. The priceless part about this effort was that by far the best negatives I now possess of the birds in question were obtained by concealing the tent in a nearby clump of viburnum bushes when the scaffolding was in process of erection, as I noticed that both birds in their agitated comings and goings frequently alighted on a particular perch not 6 feet from the ground about thirty yards from the site of our labours. Still, I was not sorry that I had gone to so much trouble as I procured a further series of the bird at and on the nest.

As I discovered eventually that this perch was at all times a great favourite with both birds, the tale certainly points a moral, and that is, study the actions of the birds you want to photograph. If you can, it pays every time to spy on your intended subjects from afar, to study their lines of approach to the nest, and to take a good look round to see what alternative routes they may use or where they may stand or perch in the vicinity of the nest. It may be with certain birds that the discovery of a nest is not essential. Some birds which feed round the margins of ponds, on the banks of rivers, or on the sea-shore, such for instance as members of the Sandpiper family, can be photographed by putting the tent close to a favoured mud spit or inlet. But whatever your intended approach to the bird may be, your study of its habits will enable you to form in your mind's eye an idea of the composition of your picture and so to select the position of the tent accordingly. Birds are often very set in their ways so that the rather sudden appearance of the tent in most cases will not cause them to alter their routes.

The actual position for the tent of course depends on a number of other conditions as well. You have to take into consideration the size of the bird and the focal length of the lens in use; on these depend the size of the image on the plate. Other factors are the conformation of the ground or tree in which it has to be anchored, the background, the immediate surroundings of the nest, the direction of the sun, and the object you are out to attain, by which I mean whether you are after a close-up of the bird only or wish to show its habitat as well.

Depth of focus is naturally bound up with the size of the bird. It is no use getting so close to a large bird that if it happens to sit facing the camera its tail is going to be out of focus. Make sure that the entire bird and all its surroundings you want shown up will be within the field of focus at the largest stop you may have to use, as any defects in focus will naturally be exaggerated in subsequent enlargements. It is really impossible to lay down hard and fast rules as to the distance of the hide from the subject so I have included a couple of illustrations from direct contact prints to show the actual size of the image obtained. In point of fact, with the 12 inch tele-anastigmat lens most of my photographs of birds varying in size from the tiny Warblers up to the size of a domestic hen have been taken at distances between 6 and 15 feet.

The conformation of the ground is naturally of importance. It may be quite impossible to put the tent just where you would most like it. Or again for purposes of concealment, it may be advisable to put it a couple of feet further away, say to conform with the line of some bushes on either side of it. This may entail a somewhat smaller image, but better a small image than a nervous bird loath to approach its nest. This of course introduces the subject of camouflage. I sometimes think I err on the side of overcaution in this respect, but I am sure a few extra minutes



A Brown Hill-Warbler about to enter its nest. Taken at F: with an spent on making the tent blend in with its surroundings will never be wasted. As a general rule the smaller the bird, the less its fear of the tent and consequently the lesser the need of elaborate concealment. Nevertheless, I always contrive to make the tent tone in with its background as much as I can.

To hide the lens is decidedly important. The hood of my large lens, which incidentally is four inches in diameter, is black. I have had a small bird refuse absolutely to face this uncovered and yet that same bird has come quite happily as soon as the black rim has disappeared under a ring of green leaves. I have now had it painted green but I still take the precaution of twisting some grass or large leaves around it.

The question of representing the lens when the camera is not in position is also a matter of concern. As far as possible, even with a bird I expect to be far from timid, I put up and camouflage the tent at least the evening before I intend to use it, as near dusk as possible. I have found that a bird will more readily return to its nest in a failing light and by the following day be quite used to the hide's proximity, consequently saving one a tiring wait as well as being more natural in its behaviour. So far I have never once had my tent tampered with except on occasion by ravenous goats and cattle out for an easy meal provided by the camouflaging material. But it is obviously unwise to leave the camera and lens out all night if it can be avoided, so I hang a black disc over the lens aperture to represent the absent lens.

A couple of years ago now I tried my luck on a Dabchick in front of whose nest a shikari I thought I had trained in my ways, had put up my hide two days previously. When I arrived I at once had occasion to find fault with him for forgetting the disc. His reply was that the bird was quite tame and had been sitting all morning.

Once the camera was in place that bird did everything conceivable except venture in front of the lens. For an hour I could have stretched out my hand and have touched it as it lay on the water in the shelter of the tent wall. Time and time again it swam round the nest under water but only on one occasion did it come to the surface for a fraction of a second to give the water a terrific slap nearly frightening the life out of a Reed-Warbler which had unwisely landed on the nest.

As I have only the one tent but may at times wish to work on two or even more birds on the same day, I often put up dummy hides of leafy branches or grass and then substitute the real tent for these when occasion arises. In each case I invariably add something, the lid of a tin, a piece of paper, the end of a bottle, to represent the lens.

I have now mentioned all the essential points I can think of in connection with the erection of the hide[1] so we can proceed to get inside it so to speak. In many ways birds seem to be rather unintelligent creatures but it does not do to imagine that they are altogether void of intellect. Any bird is certainly capable of deducing the fact that you must be in the hide if you walk up to it quite alone and suddenly disappear from view. But fortunately for us most of them seem quite incapable of distinguishing between one and two persons. It is therefore essential to have a helper to see you into the hide. Not only is his presence necessary in deceiving the birds, but he can assist in the final closing up of the hide, see that no foliage is likely to droop over the lens as it withers, and stay in the immediate vicinity until you have finished making disturbing noises moving slides and accessories into more handy positions, testing and setting the shutter, and settling in generally. Another of his duties in a populated area is to keep other people and animals at a respectful distance. It is more than annoying to have to leave the tent without photographs only to find the cause to have been due to an admiring audience sitting far to close and in full view of the nest. On one occasion this year the undesirable audience was a Cuckoo. It was really very silly of the birds to be so suspicious of it, especially as they were already feeding a large young Cuckoo, no doubt the intruder's offspring, in their own nest. But there it was; until I had signalled up the shikari to shoo the Cuckoo away from its observation post, those Redstarts were not going to visit their home.

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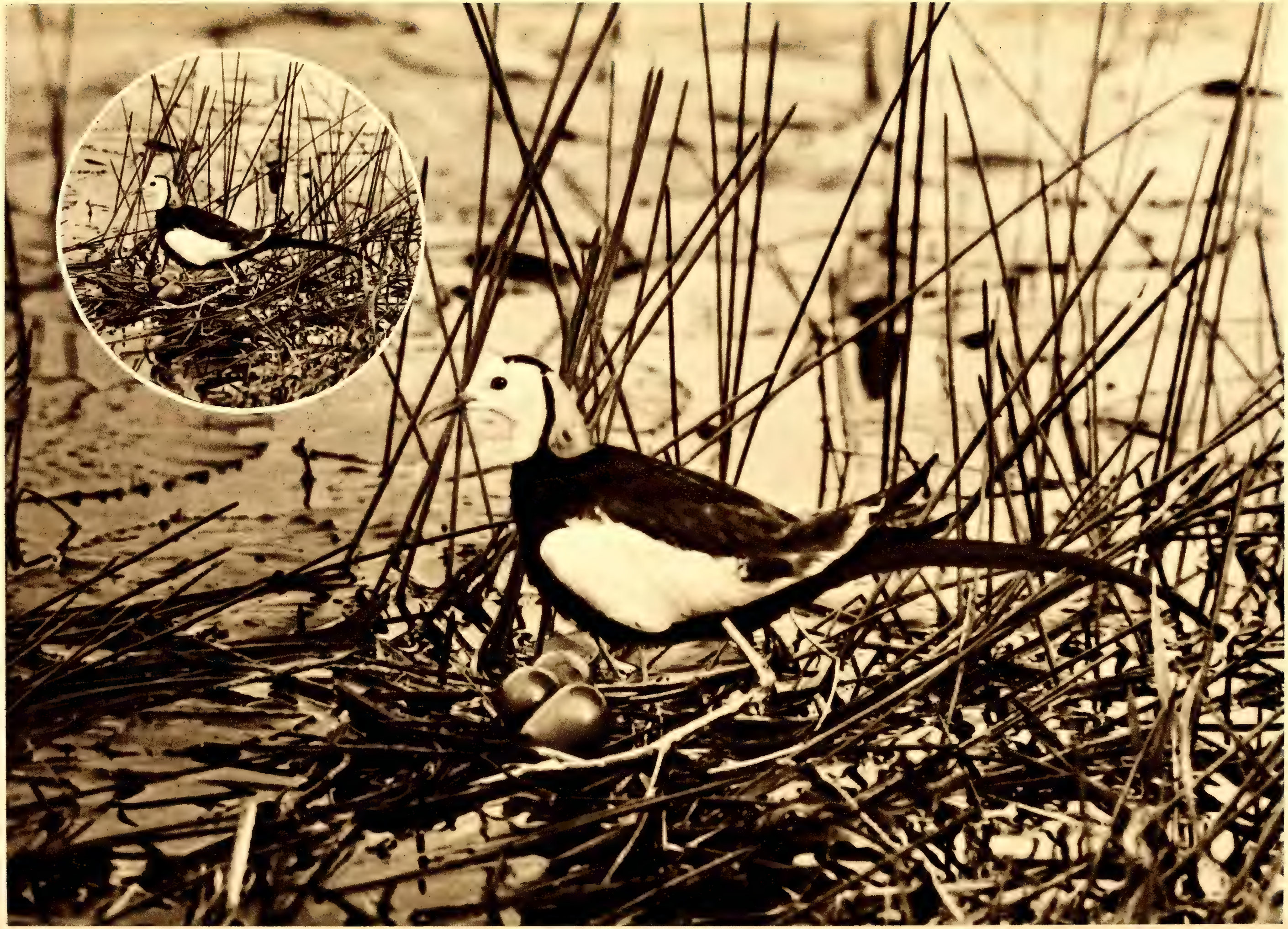
[1] It may at times be necessary, when dealing with very shy birds, to put up the tent or dummy hide some distance away, moving it up gradually to its final position.

As it is quite on the cards that a bird on its arrival at the nest will do the unexpected, it may be necessary to call up the helper to cope with the situation to save getting out of the hide yourself and thereby giving the show away that you are concealed there. I arrange with him to return at stated intervals to a distant viewpoint from which he can see my S.O.S. I wait till I think the bird is out of the way or at any rate in such a position that it cannot see the movement and then push a corner of a handkerchief out of the back of the tent.

Nearly all my work in the hide for the last twelve years has been carried out with the aforementioned Dallmeyer Tele-Anastigmat lens on a series of reflex cameras. I believe that this particular lens of 12 inch focal length working at an aperture of F3.5 is no longer made. It is certainly responsible for the rather 'soft' character of most of my photographs. Whether this softness is an advantage or a disadvantage in nature photography I leave to others to judge, but I do know that I hope to use that lens for many more years. Certainly when I see some of the very beautiful and amazingly sharp photographs in *Country Life* and *The Field* I occasionally have misgivings: they are obviously so capable of enlargement to any degree. But whatever the lens used, I consider its focal length should lie between 8 and 12 inches, preferably nearer the latter. Lenses of the combinable type, which by using the separate components give a choice of focal lengths, are most useful but seem to be somewhat out of favour these days.

I have possessed a number of reflex cameras, partly because they get treated rather roughly and partly through searching for the ideal. These have varied from 5 by 4 ins., 9 by 12 cm., to



$\frac{1}{4}$ plate, the best size probably being the last. I would however like to experiment with a $3\frac{1}{2}$ by $2\frac{1}{2}$ which in these days of small cameras and fine grain would probably be just as effective and certainly cheaper in operational costs. Plates, tanks, and all other accessories too would be less bulky and more convenient in all ways.

The ideal does not exist, but the points to look for when purchasing a reflex camera for bird or nature work generally are a not too noisy shutter which can also be reset speedily with a minimum of noise—some make an appalling prolonged series of clicks. It must be possible to alter the shutter speed with the shutter wound, and the figures should be easily readable at an angle and in a dim light. The focussing hood should be detachable. It should have a reasonably long extension and a firm lens panel not given to sagging when fully extended.

The tent is generally quite dark enough for the image to show up quite clearly on the screen without the hood, and headroom in the hide is often a problem. Without it too, it is possible to fix a mirror at such an angle just above the screen that you can sit at ease and without strain behind the camera and yet see at a glance what is in the field of view. I have fixed up the discarded mirror of my old car on my present reflex so that I can adjust its angle to suit my position behind the camera. I believe there is a special naturalist's reflex which has a monocular finder set for the purpose of viewing the screen from behind. To my mind there is one great objection to this: you cannot keep your eye glued to a small eye-piece without strain, whereas to glance every few seconds without leaning forward into a comparatively large mirror is no strain whatsoever. A periscope is perhaps the real answer to the problem.

At one time I had difficulty in altering the stops, but by fitting a long lever to the iris diaphragm's edge and screwing a notched wooden strip to the side of the camera as a guide I can now readjust the aperture of the lens in a moment with quite sufficient accuracy for all practical purposes.

In the hide the camera may often have to be quite low down, within eighteen inches or so of the ground, so a short tripod is a necessity. I have never seen a really suitable one on the market so far, but it is not difficult to adapt any of the wooden ones. It is however essential that the camera tripod and turntable should be sufficiently strong to prevent vibration. When the camera front is fully extended with a heavy lens on it, vibration set up by the movement of the mirror or focal plane shutter can be serious. The turn and tilt tops sold for small cine cameras are no good for this purpose. Something of robust construction is required, both the movements of which can be worked smoothly and quickly with one hand.

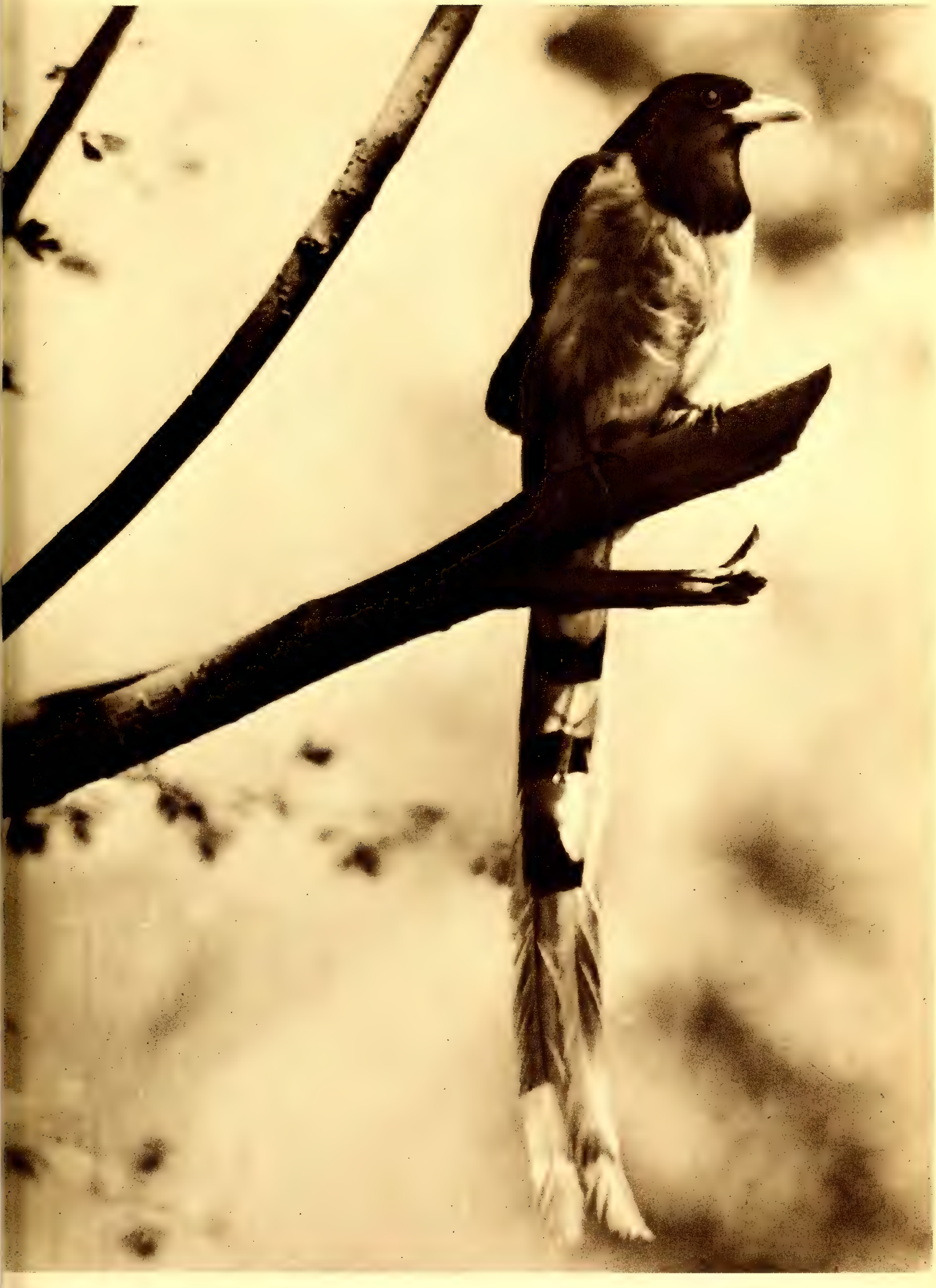
As a rule it is very unwise to chase a bird about with the lens. If it notices the movement, which ten to one it will, it is quite on the cards that you will have to pack up and go home. On the other hand it may be really worth while to take the risk. Possessing already a number of photographs of Stone Plover on the nest, I thought the risk quite worth while when I saw both birds standing close together a few feet to one side of their eggs. As it happened they spotted the lens as soon as I started to move it. I never got another photograph of either of that pair but I still think the attempt was justifiable.

On occasions two hands seem quite insufficient to cope with all there is to do. A fairly long antinous release is a help on these occasions which can be kept in the hand while working other gadgets. Most reflexes can be fitted with this type of release. It may sound rather idiotic but I seriously contemplated making use of an electric release in the hide, intending to work it by means of a bell-push under my foot so as to leave my hands free. I still think it would be well worth a trial. The 'Electrolease', as the one I contemplated buying is called, unfortunately had not come into production when I went to Kashmir last year so I have not followed up the idea.

As regards the question of exposure, I do not find it easy to proffer advice. I have been rather lax in keeping records, as I consider a bald statement of exposures and stops is of little use since there are so many varying factors to consider. Naturally there is a great tendency to cut exposure to stop movement, a tendency which must be resisted. If you are uncertain of the correct exposure, it is better to overdo it. Modern emulsions can stand great over-exposure but under-exposure cannot satisfactorily be compensated for. It is surprising what long exposures are often given in bird photography. It is a matter of choosing, or hitting upon, the right moment to release the shutter. You cannot expect every exposure to be successful. You must often work on the idea of making a number of exposures on a restless bird in the hopes that one or two of them will not show movement. I reckon that round about 80 per cent of my negatives have been obtained with exposures in the neighbourhood of 1/20th second; a number with exposures far longer than that. Two excellent plates of the Turtle Dove which illustrated my article in the *Journal* last September were each exposed for 10 seconds.

I strongly advise the purchase of a good photo-electric exposure meter. It will of course be necessary to allow somewhat for different types of subject, but within those limits, which you can only learn by experience, stick to what the meter says and you will not go far wrong. As a second string I kept my optical meter —a Biwi—which has definitely proved its worth, as twice, thanks to India's climate, my electric meter has ceased to function. On the whole exposures in bird photography need to be rather longer than for other subjects, as more often than not you will require to bring out considerable detail in the deeper shade and you are working at very close quarters.

There are two other articles of furniture which I now always take into the hide with me; one a strong folding stool which I bought at Boots' for a shilling, and the other an acquisition which I invested in two years ago and now wonder how on earth I ever did without, namely a changing bag. It is infuriating to find you have used up your last plate just as the birds are affording opportunities for better photographs than any you have obtained. Just after I had taken the photograph of the Paddy-field Warbler



The Yellow-billed Blue Magpie of the North-West Himalayas: a picture obtained through observing that the birds when disturbed at the nest often made use of this perch within 6 feet of the ground.

which also appeared in the September number of the *Journal*, the other bird arrived and sat a couple of inches below the nest for some considerable time. The two birds together would have made a delightful picture.

A large number of double plate-holders—I much prefer plates to films—take up space, besides being expensive to buy, but it is quite simple to slip a spare box of plates and the changing bag into your pocket for use in emergency. I have used the bag in the hide a number of times now. Besides, it simplifies filling the plate-holders and transferring the plates to the developing tank at any time of day when you are out in camp. For this purpose a large bag is convenient. I find the whole-plate size the most useful for my 9 by 12 cm. plates.

Every bird photographer should do his own developing and do it on the spot. It does not mean a tremendous increase in the gear to be transported. All you need in camp is the changing bag, a reliable developing tank, a thermometer, a small set of scales, an ounce measure, two or three bottles, and a limited supply of chemicals. Actually I carry a second tank for washing purposes into which the developing tank slips for packing, so that if necessary I can develop two batches of plates one after the other and so economize in solutions and time.

There are numerous advantages in doing your own developing immediately. It gives you a chance of revisiting the scene of your labours if your first efforts turn out to have been failures, and secondly you can develop for the type of negative you require. Most D. & P. firms are inclined to send out strong contrasty negatives which look lovely but are difficult or even impossible to enlarge from. It is not necessarily their fault. They mostly have to work on mass production principles, treating all plates and films alike as they have no idea of the subjects with which they are dealing. In the rains exposed plates are apt to deteriorate rather quickly, so the sooner they are dealt with the better. While yet another advantage lies in the fact that you learn of any faults in exposure at once and can apply the knowledge gained the next time you enter the hide.

Ever since they came into being I have used Ilford Hypersensitive Panchromatic plates—for the small camera for views the fine-grain version of the same films. A panchromatic emulsion is undoubtedly necessary for bird-photography. It is almost unbelievable how many brightly coloured birds can be faithfully portrayed on these materials without the use of a filter. I once hurriedly snapped a Black and Yellow Grosbeak when it was cracking pine seeds a few feet behind our tents. This however was by no means a success so the correct filter—a 'beta' is generally sufficient—is on occasion very necessary.

I am afraid I still remain faithful to the well-tried pyro developer, the formula for which is given on every box of Ilford plates. It has few ingredients and is so delightfully simple to compound. Into the bargain it produces an exceedingly good printing image. A great deal is heard these days about fine grain developers, and quite rightly so. Few direct prints are ever seen in nature photography so a negative free from objectional grain is a necessity as enlargements will greatly emphasize the mealy appearance of a coarse-grained image. For bird photography, for which the real miniature cameras are not suitable, the I.D. II or D. 76 developers are quite capable of producing a sufficiently fine-grained image without increase in exposure, but with due care the pyro developer will not unduly emphasize grain. See that both the developing and fixing solutions are at the same temperature, not too warm, do not over-develop, and all should be well. I have spoilt a number of negatives through insufficient attention to these points, and reproduce the Rubythroat photograph to show how an otherwise good negative can be reduced to mediocrity by careless processing. In this case I grossly over-developed a whole batch of 6 plates. In development as in exposure you must resist that tendency to carry it too far in a misguided effort to bring up shadow detail. Stick to the time and temperature chart for the particular plates and developer you are using and do not develop for excessive contrast which in India usually already exists to add to your difficulties.

This year I took to Kashmir all the ingredients for making up a metol-hydroquinone borax fine grain developer (I.D. II). The formula for this is as follows:—

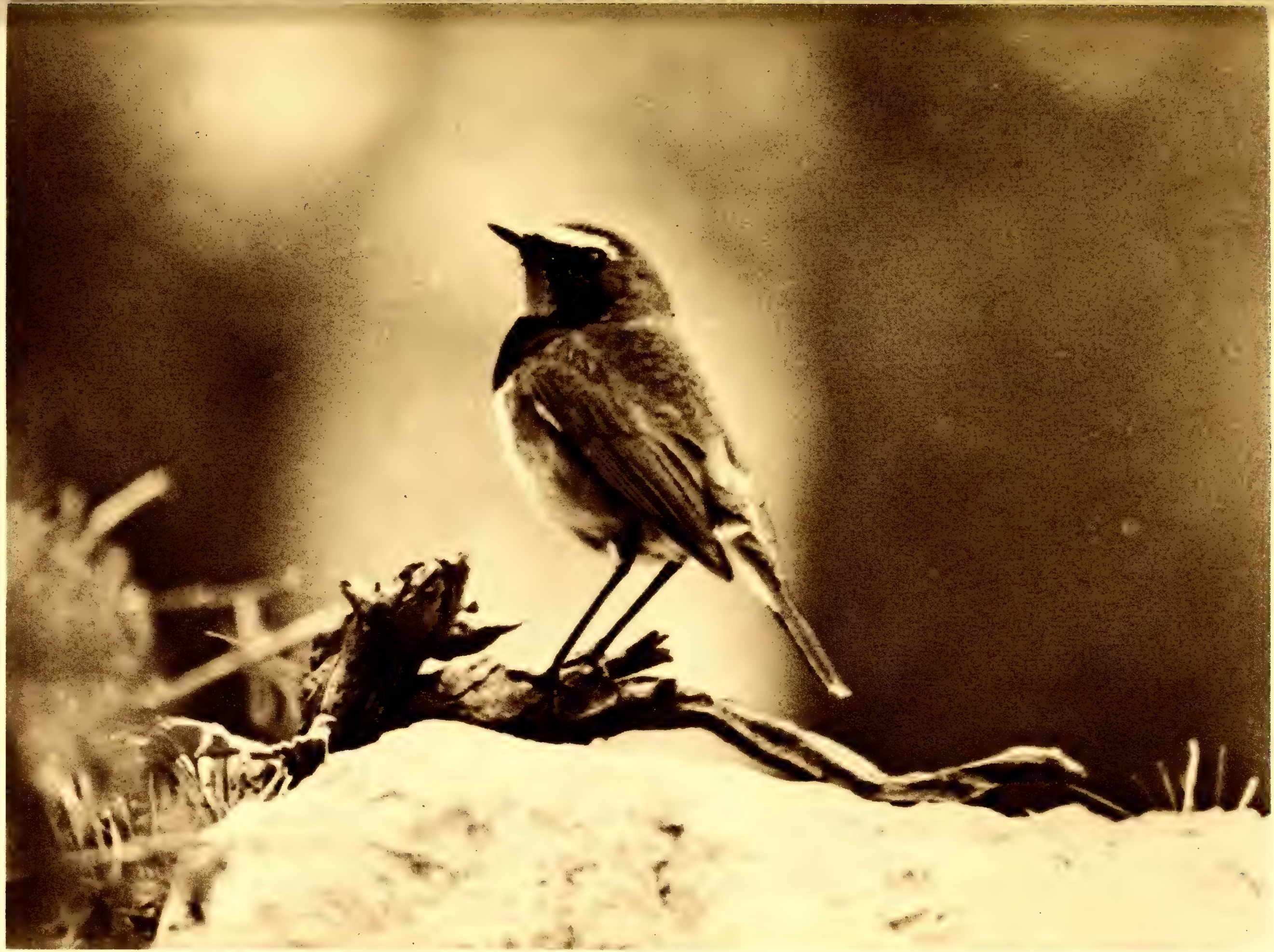
Metol	... 20 grs.
Sodium sulphite (anhydrous) ...	... 880 grs.
Hydroquinone	... 50 grs.
Borax	... 20 grs.
Water to	... 20 ozs.

It has good keeping qualities, is not laborious to make up, is economical, and to develop about 250 ¼ plates—the number I used last leave—in a tank requiring 20 ozs. of solution approximately the following quantities of chemicals will suffice:—

Metol	... 1 oz.
Sodium sulphite (anhydrous) ...	... 3 lbs.
Hydroquinone	... 2½ ozs.
Borax	... 1 oz.

These you will admit do not take up a great deal of room and compared with what you would have to pay a firm for processing this number of plates, not to mention the outlay on postage and packing, the cost of these materials, working out at under Rs. 9 is ludicrously small. If you choose to employ the pyro developer, both the bulk and cost of the chemicals will be considerably less.

Having developed your negatives it follows that you might just as well go a stage further and make your own enlargements and slides from them. Except when I am on leave, I take very few photographs of birds. I find that all my spare time in between is fully employed with the enlarging and slide making from the negatives I have accumulated. Enlarging can be very interesting as well as very simple. The greatest advantage accruing from doing your own work is that you can produce just the result you



A Himalayan Rubythroat enlarged from a negative taken and developed at 12,000 feet in Kashmir. The obvious grain detracts from the picture and was due to overdevelopment and insufficient attention to the temperature of the different

desire. In ninety-nine negatives out of a hundred only a comparatively small portion makes the picture and after all you should be the best judge of what those limits are and how the photograph should be reproduced. No amount of correspondence with a distant firm is going to produce quite the same result, besides which if special enlargements are to be made from every negative you send away it is going to come in very expensive.

All my enlarging is done with a vertical enlarger which I constructed from two derelict $\frac{1}{2}$-plate 'Triple-Victos' which you can buy for a few shillings each, and a $6\frac{1}{2}$ inch condenser mounted complete with carrier stage which I obtained from Messrs. J. J. Lancaster & Sons of Birmingham. For the lens I was lucky enough to be already in possession of a Ross Xpres salvaged from a former Reflex. The firm just mentioned sell all the parts separately for making up enlargers as well as complete instruments.

I keep a stock of Ilford glossy bromide paper, whole-plate size in soft, normal, and contrasty grades, so that employing an amidol developer I can turn out good black and white enlargements from any of my negatives eminently suitable for reproduction. Enlargements of various sizes on other grades and surfaces of paper I also turn out when the fit takes me.

I believe I also mentioned that I am in the habit of making lantern slides. They are a tremendous asset and are very easy to make with a little practice. I seldom make these slides by contact but use the enlarger to project the image the most suitable size on to the slide, sometimes slightly enlarging from the original, more often reducing it. I find it is easier to produce a good slide from a mediocre negative than it is to produce a satisfacotry enlargement from it. If amidol is used no additional chemicals are required, but I prefer a hydroquinone caustic-soda developer to the amidol as I like the blacker tones it produces. For the sake of convenience I append the formulae of the amidol and hydroquinone caustic-soda developers which are as follows :—

Amidol for Bromide Papers (I.D. 22)

Sodium sulphite (anhydrous)	220 grs.
Amidol	60 grs.
Potassium bromide	8 grs.
Water to	20 ozs.

This developer does not keep for more than two or three days.

Hydroquinone Developer (I.D. 16)

No. 1. Hydroquinone Solution.

Hydroquinone	160 grs.
Sodium sulphite (anhydrous)	1 oz.
Water to	20 ozs.

No. 2. Alkali Solution.

Sodium hydrate (caustic-soda stick)	90 grs.
Potassium bromide	35 grs.
Water to	20 ozs.

For use take equal parts of each.

Although I have allowed myself to wander off into formulae, may I hasten to add that I have no intention of turning this article into a discourse on photography in general, about which in any case I am incompetent to write, so for any of the actual processes of developing, enlarging, printing, slide making, and general tittivating of faulty negatives, may I commend you to any of the excellent manuals on these subjects produced by the makers of the plates and papers you will be using.

ADDENDUM AND CORRIGENDUM.

THE EARLY STAGES OF INDIAN LEPIDOPTERA.

PART II.

(*Journ. Bom. Nat. Hist. Soc., vol. xl, pp.* 681-92).

Agathia laetata F. Page 691 after line 5, insert

'Described from a full fed larva found in Calcutta 6-xii-31, pupated 9-xii-31, and a female emerged 23-xii-31.'

P. 686, 16th line from bottom for *Prodenia littoralis* Boisd. F. read *Prodenia litura* F.

THE EARLY STAGES OF INDIAN LEPIDOPTERA.

BY

D. G. SEVASTOPULO, F.R.E.S.

PART II.

(*Continued from page* 408 *of this volume*).

SPHINGIDÆ (*continued*).

Theretra oldenlandiae F.

Moore, *Lep. Ceyl.*, ii, 17, pl. 85, fig. 1a. 1882-83.

Hamps., *Fauna Brit. Ind.*, Moths, i, 87. 1892.

Seitz Seitz, *Indo-Austr. Bombyces*, x, 567.

Bell and Scott, *Fauna Brit. Ind.*, Moths, v, 448, pl. 6, figs. 4 and 5. 1937.

Ovum—Usual Sphingid type, pale green in colour. Deposited evening 22-vii-36. Hatched morning 25-vii-36.

1st instar—Head round, pale green. When newly hatched the ground colour is pale green and the larva is unmarked. Later the ground colour darkens and a series of seven subdorsal spots appears, from the 4th to 10th somite. Under a lens these spots have the upper half red and the lower yellow. Horn black. Moulted 27-vii-36.

2nd instar—Head and body black. A subdorsal yellow speck between the 1st-2nd and 2nd-3rd somites. A series of seven subdorsal yellow spots ringed with black from the 4th to 10th somite. Horn black with the base yellow. Legs yellow. Moulted 29-vii-36.

3rd instar—Similar to preceding. Instead of the two specks on the thoracic somites, there is now a subdorsal line consisting of a number of yellow and white dots. In most examples the spots on the 4th and 5th somites are centred with black and those from the 6th to 10th with orange. Sublateral area sprinkled with minute white dots. Moulted 31-vii-36.

4th instar—Similar to preceding. The first two ocelli with black pupils and with the black ring edged internally at top and bottom with a white and a black line. The other five ocelli with an orange horizonal stripe edged above and below with whitish. A few yellow specks at the base of the horn forming a continuation of the series of subdorsal ocelli and extending along each side of the anal somite. Horn black tipped with white. Moulted 2-viii-36.

Final instar—Head dull black. Legs pinkish. Ground colour blackish, the abdominal somites marbled with darker and with a black dorsal line. Thoracic somites with a subdorsal line of yellow and white dots and with a cream sublateral stripe merging into the sublateral white speckling of the abdominal somites. The ocelli on the 4th and 5th somites consist of a black ring edged above and below internally with a white and a black line, this encloses a yellow area with a large black pupil sprinkled with white specks. On the 6th to 10th somites the ocelli consist of a black ring, edged internally at the top and bottom with white, and enclosing a purplish spot, just below the middle of which is a paler horizontal line with yellow ends. One specimen had this line entirely yellow. A transverse dorsal stripe along the anterior edge of each of the abdominal somites formed of a series of short longitudinal cream lines. A line of yellow specks from the base of the horn extending to the anterior and posterior edges of the 11th somite. Horn black and long, the base yellow and the tip white. In all stages it is very mobile and can be moved backwards and forwards. At the beginning of each instar the ground colour is very black and the rings surrounding the ocelli are difficult to detect, later the ground colour becomes greyer and the rings are then clearly visible. Ceased feeding 5-viii-36 and pupated 7-viii-36.

Pupa—In a loose cocoon spun among litter on the surface of the ground. Bone colour with blackish shading. Abdominal somites with a dark olive green dorsal stripe. A subdorsal black dot on each somite. Spiracles set in a black spot. Intersegmental areas darker in colour. Ventrum with an interrupted black median line. The black shading more pronounced sublaterally. Thorax with two subdorsal black dots. Wing cases with a line of black specks along the costa coalescing into a blotch at the centre. Proboscis sheath forming a slight keel in front of and below the head. A male emerged 17-viii-36.

Food-plant—Garden Balsam (*Impatiens* sp.)

Described from a number of larvae; some bred from ova and others found in the 2nd and 3rd instars in Calcutta in July 1936.

Hampson's description is as follows:—'Larva pale purplish brown; a subdorsal line of yellow and white spots with a pale lateral line below them on the thoracic somites; black ringed ocelli on 4th to 10th somites, the first two centred with blue, the posterior with purple. In the early stages these posterior ocelli are centred with crimson and there are dorsal bands of yellow specks.' Seitz is no better and writes 'Larva deep dark brown, almost black, peculiarly dotted light, particularly on the sides. On the rings 4 and 5 there are lateral fictitious eyes, on the following rings only yellowish lateral spots. Horn very long and thin. On species of *Vitis, Arum decurrens, Caladium, Colocasia*, on Balsaminae and other plants. The caudal horn is very agile and may be raised and lowered (Semper). Pupa brown marked with black; it has no projecting proboscis-case but a coniform snout.'

Rhyncholaba acteus Cr.

Moore, *Lep. Ceyl.*, ii, 23, pl. 88, fig. 1a. 1882-83.
Hamps., *Fauna Brit. Ind.*, Moths, i, 100. 1892.
Seitz Seitz, *Indo-Austr. Bombyces*, x, 568.
(Bell and Scott, *Fauna Brit. Ind.*, Moths, v, 462, pl. 6, figs. 8-10. 1937.)

Ovum—Yellow green, ovoid and small for the size of the insect. Hatched 25-ix-31.

1st instar—Head yellow green, body blue green. Horn thin, about half the length of the body, black with a yellow base. Moulted 27-ix-31.

2nd instar—Head yellow green, body blue green. A large white subdorsal spot on the 4th somite and a series of smaller oval white spots outlined in dark blue from the 5th to the 10th somite, the posterior spots being less conspicuous than the anterior. Horn as in previous instar. The thoracic somites begin to assume the typical tapering Choerocampid shape. Moulted 29-ix-31.

3rd instar—Very similar to the previous one. The spot on the 4th somite develops a dark pupil. The base of the horn orange. Moulted 1-x-31.

4th instar—Head blue green. True legs orange pink. Body blue green. Thoracic somites tapered, with a dark dorsal and a pale subdorsal line. 4th somite bearing a subdorsal ocellus consisting of a yellow green ring, edged internally and externally with white, containing an indigo blue spot anteriorly, the posterior portion being bright green dotted with white. A series of seven indistinct oblique white lateral stripes. A series of six elongated yellow subdorsal spots outlined with dark blue from the 5th to the 10th somite. Horn about half an inch long, the base orange followed by a narrow black, a wide white and a wide black ring, the tip white. The whole carried erect and curved slightly forward. Moulted 3-x-31.

Final instar—Similar to the previous one except that the horn is orange pink, short, thick and curved downwards. Pupated in a slight web among leaves on the surface of the ground 8-x-31.

Pupa—Brown with a dark dorsal line and lateral stripes. Ventral surface white, a black central and two dark brown lateral stripes. Wing cases pinkish brown, the edges darker. Tongue case free and circular. A male emerged 20-x-31.

Food-plant—*Caladium.*

Described from a batch of six larvae from ova found in Calcutta. Of these, one assumed a pinkish ground colour after the first ecdysis, another after the second and three after the third, these all produced the brown form of larva described below. The sixth remained green throughout. All wild larvae that I have seen have been of the green form.

Final instar—Brown form—Head and ground colour tobacco brown. The subdorsal thoracic lines yellow. The ring of the ocellus on the 4th somite very dark brown edged internally with white and externally with yellow. The spots on the 5th to 10th somites very conspicuous, the centres bright yellow green. Other markings the same as the green form.

Hampson described the horn as yellow and does not mention the brown form. He also appears to have been ignorant of the shape of the pupa as one of the characteristics given for the Choerocampinae is 'Pupa without external sheath for the proboscis'. Seitz's description is 'Young larva green, later on often dark brown, in front very pointed; on the 4th ring a very large expressive fictitious eye, surrounded by yellow and often shaded with dark;

on the other rings lateral light ovals and below them dark oblique patches. Horn very small.'

CYMATOPHORIDÆ.

Thyatira batis L.

Hamps., *Fauna Brit. Ind.*, Moths, i, 180. 1892.

Head lobed, brown marked with rufous. Body dark purplish brown, the dorsum slightly paler. 1st somite with a slight and 2nd with a very pronounced double dorsal hump. 5th to 9th and 11th and 12th somites each with a single dorsal hump. Legs rufous. The prolegs marked externally with orange. The larva rests with the head and thoracic somites curved along the abdomen and the posterior somites held up. When small somewhat resembles the excreta of a snail.

Pupa was formed in a leaf spun to the bottom of the box. Pale fuscous brown irrorated with darker specks. The intersegmental areas darker. Head rather obtuse.

Food-plant—*Rubus* sp.

The imagines emerge about 9 p.m.

Described from a full fed larva found in Darjeeling 21-v-35, pupated 26-v-35, and a male emerged 11-vi-35.

Hampson reproduces a figure from Buckler's *Larvae Brit. Butterflies and Moths*, which shows a larva with more pronounced humps than mine, and gives the following description:—'Larva brown; the 1st somite purplish, the 2nd and 3rd yellowish; paired dorsal hump on 2nd and 5th to terminal somites; oblique lateral dark stripes on 4th to 10th somites.'

LIMACODIDÆ.

Parasa lepida Cr.

Moore, *Lep. Ceyl.*, ii, 127, pl. 128, fig. 2b. 1882-83.

Hamps., *Fauna Brit. Ind.*, Moths, i, 388. 1892.

Hamps., *Ill. Het.*, ix, 72, pl. 175, figs. 4, 4a. 1893.

Hering Seitz, *Indo-Austr. Bombyces*, x, 694.

Head brown and retractile. 1st somite retractile with a double black dorsal spot. Ground colour green. A blue dorsal stripe edged with dark olive green and then with whitish. A similar lateral stripe. A sublateral series of ten scoli tufted with urticating bristles, these are very short and mossy in appearance, the posterior two pairs with a black basal spot. A subdorsal series of ten scoli increasing in size to the 3rd, which is large and with a few red bristles in addition to the green ones, the next five very small, the 9th large and red tufted, the 10th smaller. Ventral surface whitish outlined in yellow. Some larvae have the ground colour between the dorsal and lateral stripes whitish.

Penultimate instar—Similar to the final but the area between the dorsal and lateral stripes whitish with a blue subdorsal stripe. No black basal spot on the posterior scoli. The lateral scoli themselves much longer and not so mossy in appearance. The first three and last two of the subdorsal series very much larger and tufted with black bristles, the 4th to 8th practically invisible.

Cocoon hard and dark brown, oval in shape and with some of the larval bristles, which turn black, woven into each end. In nature the cocoon is spun on the trunk of the tree on which the larva has fed and is completely covered by a web into which bits of bark are spun. Several cocoons are spun close together and they are extremely difficult to detect until the covering web has weathered away. The imago escapes by cutting a circular lid out of one end of the cocoon.

Food-plant—Mango (*Mangifera indica* Linn.), Gardenia and many others.

Described from a number of full fed larvae found in Calcutta 9-vii-36, one of which pupated 11-vii-36 and a male emerged 4-viii-36.

The larva is evidently very variable but none of the descriptions I can find applies to my examples. Hampson, in the *Fauna of British India*, describes it as 'pale green, whitish or bright yellowish green above; three dorsal mauve or green bands; subdorsal and sublateral series of short spinous tubercles, the spines of the anterior and posterior tubercles tipped with red.' In the *Illustrations of Heterocera* he writes 'The larva differs considerably in colour according to the plants upon which it has been feeding—two well marked varieties feeding on coffee and tea. The former usually have a pale greyish white ground colour, with three bright green dorsal stripes; whilst those living on the tea plant are more brilliantly coloured, having brilliant mauve stripes on a rich yellowish green ground.' The plate clearly shews the basal black spots on the posterior scoli but they are not mentioned in the text. The description in Seitz is 'Larva light green with three dorsal yellow or green bands, with subdorsal and lateral spined appendages, the spines of the anterior ones being spotted red.'

Natada suffusa Moore (=*Macroplectra nararia* Moore f. *cosmiana* Swinh. (=*suffusa* Moore)).

Hamps., *Fauna Brit. Ind.*, Moths, i, 381. 1892.

Moore, *Lep. E.I. Co.*, 415, pl. 21, figs. 8, 8a. 1857-1859.

Head brown and retractile. Ground colour green. A purple brown dorsal stripe, broad anteriorly and narrowing to a line on the 7th somite, from which it again broadens posteriorly. A yellow spot on each side of the dorsal stripe on the 7th somite. A series of 11 lateral projections with urticating bristles, the 1st and 2nd short, red and directed forwards, the 3rd red, long and directed sideways, the 4th to 10th short, green and directed sideways and the 11th long, green and directed backwards. A double dorsal row of tufts of very short urticating bristles. In some examples the dorsal stripe is almost obsolete.

Cocoon—Spherical, purplish brown.

Food-plant—*Lagerstroemia indica* Linn. (Crape Myrtle).

Described from a full fed larva found in Calcutta 25-xii-31, pupated 28-xii-31, and a male emerged 19-i-32.

Hampson describes the larva of *N. nararia* Moore, which he makes conspecific with *suffusa*, as 'yellowish green above, pink below; a yellow or pinkish dorsal band; a subdorsal series of red tipped spinous tubercles; a sublateral series of larger whitish tubercles with very short spines, the tubercles at each end being long, those at the posterior end longest.'

NOCTUIDÆ.

Polytela gloriosae F.
Moore, *Lep. Ceyl.*, iii, 13, pl. 145, fig. 1a. 1884-87.
(Hamps., *Fauna Brit. Ind.*, Moths, ii, 168. 1894.)
(Warren Seitz, *Indo-Austr. Noctuidae*, xi, 86.)

Head brown. Legs brown with black tarsi. Prolegs orange. Ground colour purplish black. 1st somite with an orange dorsal blotch edged anteriorly with six black and posteriorly with two white spots. 2nd and 3rd somites each with an ovate orange subdorsal blotch containing a black dot and with a white spot on the outer edge. 1st to 12th somites with a white dorsal spot on the posterior edge of each somite, the 6th to 12th somites with a smaller white spot on the anterior edge as well. 4th to 9th somites each with two subdorsal white spots. 10th to 12th somites each with an orange subdorsal blotch. A lateral white spot between each somite from the 1st to 11th. 3rd to 11th somites with a sublateral white spot on the anterior portion of each somite. The dorsal and lateral spots largest.

Pupa reddish brown, subterranean.

Food-plant—Various kinds of Lily, particularly *Gloriosa superba,* and *Amaryllis.*

Described from a full fed larva found in Calcutta 31-vii-32, buried itself 2-viii-32 and a male emerged 14-viii-32.

Seitz gives the ground colour as 'purplish brown irrorated with silvery blue' and describes the white spots as yellow. Hampson describes the larva as 'smooth, purple black with dorsal, lateral and sublateral series of white spots; purplish lateral blotches on thoracic and two terminal somites; head, legs and a dorsal spot on 1st somite red'. (Hampson's description seems to be based on that of Moore, whose figure shews a larva with dull brownish lateral blotches on the 2nd, 3rd, 11th and 12th somites.)

Prodenia littoralis Boisd F.
Moore, *Lep. Ceyl.*, iii, 19, pl. 146, fig. 1b. 1884-87.
Hamps., *Fauna Brit. Ind.*, Moths, ii, 247. 1894.
Warren Seitz, *Indo-Austr. Noctuidae*, xi, 320.

Head black with an inverted yellow V. Legs black. Ground colour purplish black, a subdorsal series of triangular black marks, the apices directed towards the dorsum. 2nd and 3rd somites each with a subdorsal yellow spot; 4th to 9th somites each with a dull reddish subdorsal spot. Ventral surface paler. Claspers brown.

Pupa subterranean, of typical Noctuid shape. Colour bright chestnut brown, the skin between the somites and a dorsal line darker. Spiracles surrounded by a dark ring.

Food-plant—Very varied. I have found it on *Antirrhinum, Zinnia*, Spinach, Lettuce, Castor and *Caladium*, whilst Moore records *Lantana* as a food-plant. In captivity it will eat almost anything.

Described from a full fed larva found in Calcutta 27-ii-35, buried itself 1-iii-35 and a male emerged 13-iii-35.

Hampson's description, which is copied almost word for word from Moore, is 'Pale violet brown, with a subdorsal series of narrow yellow spots with black lunules above them; a lateral series of purplish black spots centred by a white dot; a sublateral white line.'

Spodoptera mauritia Bsd.

Warren Seitz, *Indo-Austr. Noctuidae*, xi, 321.

Head olive brown with an inverted pale Y. Ground colour dark grey. 1st somite with a white dorsal line, which is continued along the dorsum as a more or less well pronounced purplish stripe. A subdorsal pale stripe, edged above with a black lunule on each somite. A sublateral pale stripe edged above with purplish. Ventral surface greenish.

In the 1st instar the larva is green with a black head. The head becomes brown after the first ecdysis. Some larvae become brown in the 4th instar, whilst others remain green with a brown lateral stripe, a few having a brown dorsal stripe in addition. All become brownish grey in the 5th instar with the adult markings more or less pronounced.

Pupa in a slight earthen cocoon just below the surface of the soil. The pupae vary considerably in colour, most of them are mahogany with the abdominal somites paler but a few are unicolorous yellow brown.

Food-plant—Grasses.

Described from a number of larvae bred from ova in Calcutta, one of which pupated 12-iii-38 and a male emerged 20-iii-38.

Seitz's description is 'Larva dark brown marbled with whitish; dorsal line white edged; subdorsal and lateral lines white; head red brown; venter greenish; feeding on cereals, reported to be injurious to rice in the Punjab.'

Sphetta apicalis Wlk.

Moore, *Lep. Ceyl.*, ii, 114, pl. 121, fig. 2a. 1882-83.

Hamps., *Fauna Brit. Ind.*, Moths, ii, 167. 1894.

Head pale yellow with a few coarse hairs. Ground colour grey. A white subdorsal line, straight on the thoracic somites but forming a series of Vs with their apices directed backwards on the abdominal. A white lateral line and a yellow sublateral stripe. Each somite with a black lateral and a yellow sublateral setiferous tubercle. 3rd to 12th somites each with four subdorsal setiferous tubercles, those on the 3rd black, on the 4th, 5th and 6th red, on the 7th, 8th and 9th the inner black and the outer red, on the 10th black, on the 11th red and on the 12th the inner black and the outer red. Anal plate marked with red. Ventral surface pale greenish.

Pupa dark mahogany brown. A slight projection between the eyes. The cremaster a bunch of hooked spines. In a slight cocoon between two leaves.

Described from a full fed larva found at Peshoke (2,500 ft. Darjeeling District) 21-xii-36, pupated 5-i-37, and a male emerged 24-i-37.

Moore's description, most of which is copied by Hampson, is 'Larva greyish blue above, green below, with a longitudinal waved darker greyish blue lateral band dividing the two colours; a dorsal row of blunt tubercles from fifth segment, and a subdorsal row of small black spots, one on each segment, the dorsal tubercles and anterior segments with a few short blackish hairs, and a single hair from each segment below the lateral line. Pupa purple brown.' In the figure the shape is distorted but the red tubercles are clearly shewn.

Chloridea obsoleta F. (=*Heliothis armigera* Hbn.).
Moore, *Lep. Ceyl.*, iii, 51, pl. 150, fig. 1a. 1884-87.
Hamps., *Ill. Het.*, ix, 92, pl. 176, fig. 22. 1893.
Hamps., *Fauna Brit. Ind.*, Moths, ii, 174. 1894.
Warren Seitz, *Indo-Austr. Noctuidae*, xi, 308.

Head small, colour very variable. Body with a few hairs, the colour very variable, the only constant feature being a white line along the anterior edge of each proleg.

Form 1. Head green. Body green with a darker dorsal line due to the contents of the intestines. A darker lateral line above the spiracles and a white sub-spiracular line. Ventral surface brighter green.

Form 2. Head very pale brown. Body yellow green with a paler sub-spiracular line. The 4th to 10th somites each with an indistinct rust coloured subdorsal blotch, that on the 4th somite largest. Ventral surface darker green.

Form 3. Head very pale brown. Body pinkish grey, the 1st somite less tinged with pink. A grey dorsal and lateral stripe. A pink spiracular stripe edged above and below with a white line. 4th to 11th somites each with a darker grey subdorsal blotch joining the lateral stripe and, on the 4th and 11th somites, joining the dorsal stripe as well. 5th to 10th somites each with a pair of black dorsal spots. Ventral surface paler.

Form 4. Head pale olive brown. Body putty colour tinged with pink. A greyish dorsal stripe rather more pronounced on the 11th somite. A whitish sub-spiracular line. Ventral surface tinged with green.

Form 5. Head honey colour. Body pale olive brown. A darker dorsal stripe more pronounced on the 11th somite. A darker subdorsal stripe and a whitish sub-spiracular stripe. Ventral surface whitish tinged with green.

Food-plant—Carnation, *Antirrhinum* and other cultivated plants, the larvae preferring the flowers. They are semi-nocturnal and cannibalistic.

Pupa subterranean in an earthen cocoon. Noctuid in shape but long and slender. Abdomen yellowish brown with a dark dorsal line, the intersegmental areas darker brown. Thorax tinged with olive green. Wing cases anteriorly olive green shading into yellowsh brown posteriorly. Cremaster a very long double spine, Described from a series of full fed larvae found in Calcutta, one of which pupated 16-iii-34 and a male emerged 28-iii-34.

Hampson's description is 'Dorsal area pale brown; a lateral whitish band; ventral area pale green; each segment with some black specks; head red brown. Or green with a dark dorsal and two yellow lateral lines; the thoracic somites speckled brown and black, 5th to 10th somites with lateral brown blotches, anal somite with an irregular black dorsal mark. Feeds on rose buds.' Moore's figure shews a pale green larva with a subdorsal series of large pear-shaped black blotches.

Anua (*Ophiusa*) *coronata* F.

Moore, *Lep. Ceyl.*, iii, 158, pl. 166, fig. 5. 1884-87.

(Hamps., *Fauna Brit. Ind.*, Moths, ii, 502. 1894.)

Head brown, a yellow stripe along the median suture, a submedian yellow line and a pink stripe edged anteriorly with yellow and posteriorly with black. Body sienna brown, a double dorsal, a double subdorsal and a lateral line of somewhat paler brown. The dorsal lines touch twice on the 8th somite enclosing a dark spot. A pair of subdorsal yellow tubercles on the 11th somite. Ventral surface light brown with darker specks. Claspers externally very dark brown with a transverse yellow stripe, orange internally. A velvety black spot between the first and another anterior to the second pair of prolegs. I found one example in which the ground colour was flesh pink.

Pupa dark purple and enclosed in a slight cocoon of gummy silk spun, in captivity, between leaves.

Food-plant—*Quisqualis indica* Linn.

Described from a full fed larva found in Calcutta 19-x-31, pupated 26-x-31, and a male emerged 9-xi-31.

Hampson's description appears to have been made from an immature, preserved specimen. The yellow edged lateral spot on the 5th somite is only present in immature examples. The brown stripes of the head darken to black in preserved specimens. The mention of paired black tubercles on the 10th and 11th somites must be a mistake, the pair on the 11th somite is the only one present and that is yellow. (Hampson's description is based on that of Moore, whose figure shews a considerably shorter and stouter larva than mine.)

Parallelia (*Ophiusa*) *algira* L.

Head reddish brown with a pair of triangular pale yellow spots on the vertex. Body long and thin. Ground colour pinkish brown. A pale double dorsal line, edged on each side by a narrow blackish stripe. A narrow lateral stripe slightly darker than the ground colour and a blackish sublateral stripe. A reddish brown subdorsal dot on the anterior portion of the 4th somite. None of the stripes is of solid colour but each is composed of minute dots superimposed on the ground colour. Ventral surface pale with a black median stripe expanding slightly between each pair of prolegs. Legs reddish brown. Claspers marked internally with carmine, externally the base with a few minute blackish dots, the apex marked with carmine. 1st pair obsolescent. A pair of red dorsal tubercles on the 11th somite.

Pupa between two spun together leaves. Purplish black covered with a white bloom. Spiracles very noticeable.

Food-plant—Castor (*Ricinus communis* Linn.).

Described from a full fed larva found in Calcutta 20-vi-38, pupated 23-vi-38, and a male emerged 2-vii-38.

Phytometra jessica Btlr.

Head and legs pale green. Ground colour pale green. A double white dorsal line, a double white subdorsal line and a white lateral line. A few short white hairs springing from white freckles. 1st and 2nd pairs of prolegs obsolete. Body narrow anteriorly, broadening posteriorly. One example had the head and legs marked with black and a black lateral dot in the middle of each somite.

Pupa pale green with a brown subdorsal spot on the posterior edge of the thorax and with the skin of the dorsum between the 1st, 2nd, 3rd, 4th, 5th, 6th and 7th abdominal somites brown. Proboscis sheath slightly longer than the wing cases. Enclosed in a hammock shaped cocoon of thin white silk, in nature presumably spun on the underside of a leaf.

Food-plant—*Antirrhinum* flowers.

Out of five larvae, two died from the attacks of a fungoid disease and one was killed by hymenopterous parasites.

Described from a full fed larva found in Calcutta 9-iii-35, pupated 11-iii-35, and a female emerged 17-iii-35.

Cosmophila erosa Hbn.

Moore, *Lep. Ceyl.*, iii, 84, pl. 155, fig. 1b. 1884-87.

Hamps., *Fauna Brit. Ind.*, Moths, ii, 411. 1894.

Head green. Body green with a dorsal, subdorsal, lateral and sublateral line of minute white dots. Shape long and slender, the first pair of prolegs aborted, the second partially so. Some examples with a darker dorsal stripe.

Pupa in a spun together leaf. Rather slender with a small tooth projecting forward from between the eyes. Colour dark purple brown, the thorax darker than the rest.

Food-plant—Garden Hollyhock (*Malvaceae*).

Described from a full fed larva found in Calcutta 8-ii-38, pupated 11-ii-38, and a male emerged 21-ii-38.

Moore's figure shews a plain green larva with red prolegs and this feature is mentioned in his description and also in Hampson's, who more or less copies him. Both give *Hibiscus*, also *Malvaceae*, as the food-plant.

GEOMETRIDÆ.

Agathia laetata F.

Moore, *Lep. Ceyl.*, iii, 437, pl. 197, fig. 1b. 1884-87.

(Hamps., *Fauna Brit. Ind.*, Moths, iii, 487. 1895.)

(Prout Seitz, *Indo-Austr. Geometridae*, xii, 69.)

Head brownish. Ground colour dark green dorsally suffused with dull reddish purple. 1st somite divided into two lobes and posterior somites slightly swollen. Very like the new growth of *Oleander,* on which it feeds.

Pupa in a spun together leaf. Buff coloured with dark dorsal markings.

Food-plant—Oleander (*Nerium odorum* Soland).

Hampson's description is 'larva green with dorsal prominences on 1st and 11th somites. Pupa yellowish green above, green below, the abdominal somites black-speckled' and this is copied by Seitz, except that the dorsal prominences are said to be on the 'prothorax and 8th (?) abdominal somite.'

Photoscotosia miniosata Wlk.

Head small, pale olive green. Ground colour pale green, 1st to 3rd. somites with a rufous dorsal stripe with a dark median line. 4th to 8th somites each with a rufous triangular dorsal mark, the apex directed forwards, 9th to 11th somites with a similar, but much fainter, mark. Last somite and anal claspers dark olive brown.

Pupa very dark purplish brown with the intersegmental areas paler. Pupated in a spun together leaf.

Food-plant—*Rubus* sp.

Described from a full fed larva found in Darjeeling 11-v-35, pupated 14-v-35, and a female emerged 2-vi-35.

Percnia ductaria Wlk.

Head and the dorsum of the 1st somite yellow brown, the latter with two black spots. Ground colour black, the skin shining as if oiled, with a yellow dorsal and sublateral and a white subdorsal and lateral stripe. Venter with a white median and lateral stripe. Legs yellow, claspers yellow marked with black. The skin is extremely thick and tough.

Pupa slender, very dark mahogany brown. In captivity in a slight earthen cocoon just below the surface of the soil.

The larvae are semi-gregarious, several being found on the same bush of the food-plant (name unknown) but it is rare to find more than two on one leaf.

Described from a number of full fed larvae found at Peshoke (2,500 ft. Darjeeling District) 23-xii-36, one of which pupated 3-i-37 and a male emerged 19-i-37.

Buzura (*Biston*) *suppressaria* Guen.

Moore, *Lep. Ceyl.*, iii, 407, pl. 188, fig. 1b, 1c. 1884-87.

(Hamps., *Fauna Brit. Ind.*, Moths, iii, 247. 1895.)

Head lobed, mottled brown. Ground colour mottled brown. 1st somite lobed. 2nd to 11th somites with a pair of pale dorsal spots. 11th somite with a transverse black stripe. Pale lateral tubercles on 7th and 8th somites. Spiracles red. Anal plate and claspers reddish.

Another form has the ground colour dark green with a darker dorsal stripe and dark suffusion between the somites. A lateral patch on the 3rd somite, a transverse stripe on the 11th and the anal claspers black.

Pupa very dark purple, almost black. Abdomen ending in a long anal spike. Subterranean.

Food-plant—*Cassia* sp. and *Lagerstroemia indica* Linn. (Crape Myrtle).

Described from a full fed larva found in Calcutta 9-xi-31, buried itself 11-xi-31 and a female emerged 11-i-32.

Hampson describes the green form only and says that the larva of the female is paler than that of the male. I have not observed this.

PYRALIDÆ

Sylepta derogata F.

Fletcher, *Some South Indian Insects*, pl. xxxv, figs. 2, 3 and 4.

Head brown, legs black. Ground colour green; 1st somite with two black dorsal spots. A white spiracular line. Clothed with sparse hair. Lives in a spun together leaf. Before pupating the larva turns pink.

Pupa reddish brown in a spun together leaf.

Food-plant—Hollyhock.

Described from a full fed larva found in Calcutta 6-iv-32, pupated 9-iv-32, and a male emerged 15-iv-32.

Correction

NYMPHALIDÆ.

Euthalia garuda Moore, *suddhodana Fruhs.*

On page 398 of vol. xl of this *Journal*, I described this larva as having a series of *eleven* feathery scoli. This should, of course, be *ten*. The '2nd to 10th' and the '11th' in the following lines should be corrected to '2nd to 9th' and '10th'.

ARCTIIDÆ.

Utetheisa pulchella L.

The description appearing under this name on page 402 of vol. xl of this *Journal* is really of the larva of *Utetheisa lotrix* Cr. and the heading should be read accordingly. Specimens bred this year have been determined by the British Museum (Natural History) and I understand that this species has not been bred before. The reference originally quoted apply to true *pulchella*.

(*To be continued*).

THE MEDICINAL AND POISONOUS CRUCIFERS OF INDIA.

BY

J. F. CAIUS, S.J., F.L.S.

The CRUCIFERÆ are a very important Natural Order, and one which includes many esculents and few poisonous or medicinal plants. They are annual, biennial, or perennial herbs without milky juice. They are dispersed all over the world; reaching, in the polar regions and on the highest mountains, the limits of flowering-plant vegetation. The family consists of 220 genera and 1,900 species; most of these inhabit the South of Europe and Asia Minor; they are rarer in the tropics, in extra-tropical and temperate South America. Several species are cultivated in numberless varieties and forms as vegetables.

The members of the Order are acrid, stimulant, and anti-scorbutic; seeds oleaginous, frequently pungent.

The following have been isolated from different parts of the plants:—(1) *alkaloids*—cheirinine, sinapine—; (2) *aromatic alcohols*—inositol—; (3) *enzymes*—myrosin—; (4) *glucosides*—cheirolin, glucocheirolin, glucotropoeolin, sinalbin, sinigrin—; (5) *acids*—behenic, erucic, fumaric, myronic, oleic, stearic—; (6) *pigments*—quercetin—; (7) *mustard oils*—allyl, benzyl, phenyl ethyl.

The medicinal and poisonous crucifers of the world belong to 45 genera:—ALLIARIA (temperate Europe; Asia); ALYSSUM (Mediterranean; Europe); ARABIDOPSIS (Europe; Western Asia); ARABIS (northern temperate regions; south America); BARBAREA (northern temperate regions); BERTEROA (northern temperate regions of the Old World); BRASSICA (Mediterranean; Europe, Asia); BUNIAS (Mediterranean; Asia); CAKILE (northern temperate regions); CAMELINA (Mediterranean; Europe); CAPSELLA (temperate and sub-tropical regions); CARDAMINE (cosmopolitan; chiefly temperate regions); CHEIRANTHUS (Mediterranean; northern temperate regions); CLYPEOLA (Mediterranean); COCHLEARIA (Europe, Asia Minor); CRAMBE (Mediterranean; Europe, Asia, Polynesia, Patagonia); DENTARIA (northern temperate regions); DESCURAINIA (northern temperate regions; South America); DIPLOTAXIS (Mediterranean; Europe); DRABA (northern temperate and arctic regions; south-western North America); EROPHILA (Mediterranean; Europe); ERUCA (Mediterranean); ERYSIMUM (Mediterranean; Europe; Asia); FARSETIA (Mediterranean); HELIOPHILA (South Africa); HESPERIS (Mediterranean; Europe); IBERIS (Europe, Asia); IODANTHUS (Atlantic North America); ISATIS (Mediterranean; Europe; Asia); LEPIDIUM (cosmopolitan); LUNARIA (Europe); MATTHIOLA (Mediterranean; Europe, South Africa); MORICANDIA (Mediterranean); NASTURTIUM (cosmopolitan); RADICULA (North America); RAPHANUS (Mediterranean; Europe; Java); RAPISTRUM (Mediterranean; central Europe); RORIPA (northern hemisphere); SENEBIERA (subtropical regions; Europe); SESELI (Europe, Africa, Asia, Australia); SISYMBRIUM (northern temperate regions); THLASPI (northern temperate regions); THYSANOCARPUS (California); VESICARIA (Europe); WASABIA (Japan).

The medicinal and poisonous crucifers of India belong to 24 genera:—ALLIARIA, ALYSSUM, ARABIDOPSIS, BARBAREA, BRASSICA, CAPSELLA, CARDAMINE, CHEIRANTHUS, COCHLEARIA, CRAMBE, DESCURAINIA, DRABA, EROPHILA, ERUCA, ERYSIMUM, FARSETIA, ISATIS, LEPIDIUM, MATTHIOLA, MORICANDIA, NASTURTIUM, RAPHANUS, SISYMBRIUM, THLASPI.

A. Pods narrow, long. Seeds usually uniseriate (pods sometimes short in *Nasturtium*)
  I. Sepals narrow, erect; valves without horns or appendages; stigmas erect, connate or decurrent on the style ... ... MATTHIOLA.
  II. Sepals broad or narrow; stigma undivided or shortly bilobed
    a. Sepals erect, lateral saccate.—Hoary, leafy erect herbs ... ... CHEIRANTHUS.
    b. Sepals spreading, not saccate; pods tumid; seeds minute, biseriate. Flowers usually yellow ... NASTURTIUM.
    c. Sepals not saccate; pods 4-angled; seeds uniseriate. Flowers yellow ... ... BARBAREA.
    d. Sepals not saccate; pods hardly nerved, usually acute; stamens simple. Flowers white or purple ... ... CARDAMINE.

B. Pods short, broad. Seeds usually biseriate (pods sometimes long and seeds uniseriate in *Farsetia*)
  I. Pods 2-celled; sessile, many-seeded. Seeds compressed, often winged, uniseriate ... ... FARSETIA.
  II. Pods 1-2-celled, 2-many-seeded, valves often tumid. Seeds biseriate (sepals never saccate). Flowers white or yellow ......
    a. Sepals, short, spreading. Glabrous herbs ... COCHLEARIA.
    b. Stamens often appendaged; pods usually orbicular and 4-seeded.—Hoary herbs ... ... ALYSSUM.
    c. Stamens not appendaged; pods longer than broad, many-seeded.—Hoary herbs
      † Petals entire ... ... DRABA.
      †† Petals bifid ... ... EROPHILA.

C. Pods usually sessile, long, narrow. Seeds usually 1-seriate. Stigma capitate, emarginate or shortly bilobed
  I. Flowers yellow, pedicelled, ebracteate. Pods terete, valves 3-nerved ... ... SISYMBRIUM.
  II. Flowers white. Pods terete, valves 1-3-nerved. Seeds smooth or striate ... ... ALLIARIA.
  III. Flowers yellow, pedicelled, ebracteate. Pods cylindric or flat, valves 1-nerved ... ... DESCURAINIA.
  IV. Flowers white, purple or rose-coloured. Valves of the terete or compressed pod 1-nerved or nerveless ... ARABIDOPSIS.
  V. Flowers yellow, rarely purple, ebracteate. Pods elongate, narrow, compressed tetragonal or terete; valves linear, 1-nerved, frequently keeled ... ERYSIMUM.

D. Pods short or long, cotyledons longitudinally folded or deeply grooved
  I. Stigma capitate, truncate or 2-lobed
    a. Pods long. Seeds uniseriate ... ... BRASSICA.
    b. Pods short, turgid, beaked. Seeds biseriate ... ERUCA.
  II. Stigmas connate, forming an erect cone. Pods long. A glaucous large herb or undershrub ... ... MORICANDIA.

E. Pods short, dehiscing throughout their length, compressed laterally at right angles to the septum
  I. Cotyledons incumbent, straight, curved or longitudinally folded
    a. Pods many-seeded, valves not winged ... CAPSELLA.
    b. Pods few-seeded, valves winged or not ... LEPIDIUM.
  II. Cotyledons accumbent, straight. Pods compressed notched; valves winged or keeled ... ... THLASPI.

F. Pods short, indehiscent, not jointed, usually hard
  Pods 1-celled, oblong or linear, wing thick.—Glaucous herbs ... ... ISATIS.

G. Pods long or short, transversely jointed; joints indehiscent or the lower 2-valved or reduced to a pedicel for the upper
  Lower joint of pods a seedless pedicel, upper globose 1-seeded ... ... CRAMBE.

H. Pods long, not jointed, indehiscent, either 1-celled and many-seeded or breaking up into many 1-celled, 1-seeded indehiscent fragments
  Pods long, terete, hollow or septate; seeds globose 2-3-celled ... ... RAPHANUS.

ALLIARIA.

The two species of this genus inhabit Western Asia, Europe, and North Africa.

Alliaria officinalis Andrzej. is found in the Western Himalaya from Kumaon to Kashmir, at 6,000-10,000 feet. From Afghanistan it extends westwards to the Mediterranean, Central and subarctic Europe.

The herb and seeds are esteemed diuretic, diaphoretic, and expectorant, and are used as external application in gangrenous affections, and to promote suppuration, healing of cuts, bruises and ulcers.

In England the leaves used to be taken internally as a sudorific and deobstruent, and externally were applied antiseptically in gangrenes and ulcers. The juice of the leaves taken alone or boiled into a syrup with honey is found serviceable in dropsy.

The plant is to be used fresh, for it loses its properties on drying.

Dutch: Lookkruid, Look zonder look—; *English*: Beggarman's Oatmeal, Cardiacke, Caspere, Eileber, English Treacle, Garlick-roast, Hedge-garlick, Jack-by-the-hedge, Leek-cress, Garlick Mustard, Penny Hedge, Poor Man's Garlic, Poor Man's Mustard, Poor Man's Treacle, Sauce-alone, Swarms—; *French*: Alliaire, Herbe aux ailles, Herbe aux aillets, Herbe aux aulx, Julienne alliaire—; *German*: Knoblauchhederich, Knoblauchkraut, Knoblauchsrauke—; *Greek*: Skordion—; *Italian*: Erba alliaria—; *Pacific Coast*: English Treacle, Garlic Mustard, Garlicwort, Hedge Garlic, Hedge Mustard, Leek Cress, Poor Man's Mustard—; *Portuguese*: Alliaria—; *North America*: Hedge Garlic—; *Russian*: Chessnovitsa—; *Spanish*: Aliaria—.

ALYSSUM.

The genus includes 120 species, natives of Europe, the Mediterranean region as far as Central Asia, the Canary Islands, Madeira; naturalised elsewhere.

Alyssum maritimum Lam. is cultivated in gardens in North-western India.

The plant is commonly used in Spain as an antiscorbutic and diuretic. In Barcelona it is highly esteemed as an astringent for gonorrhoea.

Catalan: Caps blancs, Herba blanca, Sempre en flor—; *English*: Sweet Madwort—; *French*: Alysse, Alysse maritime, Alysse odorant, Alysson, Corbeille d'argent, Corbeille d'or—; *German*: Steinkraut—; *Malta*: Allison, Sweet Alysson, Buttuniera—; *Roumanian*: Galbenus, Lubit—; *Russian*: Taritsa—; *Spanish*: Aliso de mar, Bosqueletes anchos, Bosqueletes de dama, Bosqueletes de plata, Mastuerzo maritimo—.

ARABIDOPSIS.

The genus consists of 11 species distributed over Europe, Asia, and Africa.

Arabidopsis thaliana (Linn.) Heynh. is found in Kashmir at 5,000-10,000 feet, and in Kumaon. It extends to Afghanistan, Western Asia, Central Europe, and the Mediterranean region; it has become naturalized in North and South America, South Africa and Australia.

It is used in Spain and other parts of Europe to cure sores in the mouth.

English: Thale Cress—.

BARBAREA.

The genus consists of 15 species of the northern temperate regions, chiefly European.

Barbarea vulgaris Br. is found in the temperate and subalpine Himalaya and Western Tibet at 6,000-10,000 feet. It is distributed to Western Asia, Europe, North and South Africa, and Australia.

In Spain the leaves are a reputed vulnerary.

In La Reunion the plant is used as a stimulant and antiscorbutic.

Catalan: Herba barbara, Herba barbera, Herba de Santa Barbara—; *English*: Winter Cress, Yellow Rocket—; *French*: Barbarée, Barbarée vulgaire, Cresson de terre, Cresson vivace, Girarde jaune, Herbe aux charpentiers, Herbe de sainte Barbe, Herbe de saint Julien, Herbe de sainte Marguerite, Julienne jaune, Rondotte—; *German*: Barbarakraut, Erdkresse—; *La Reunion*: Cresson de terre—; *Pacific Coast*: Bitter Cree, French Cress, Hedge Mustard, Land Cress, Normany Cress, Rocket Cree, St. Barbara's Cress, Winter Cress, Winter Rocket, Yellow Rocket—; *Spanish*: Yerba de los carpinteros, Yerba de Santa Barbara—.

BRASSICA.

The genus numbers 33 species, often polymorphic, chiefly Mediterranean.

The seeds of most of them are stimulant and laxative.

The following species are used medicinally in Europe—*B. campestris* Linn., *B. Napus* Linn., *B. nigra* Koch., *B. oleracea* Linn., *B. Rapa* Linn.—; in Japan—*B. campestris* Linn.—; in China—*B. campestris* Linn., *B. cernua* Thunb., *B. Napus* Linn. var. *chinensis* (Linn.) O. E. Schulz, *B. oleracea* Linn., *B. Rapa* Linn.—; in Indo-China—*B. campestris* Linn., *B. integrifolia* (West.) O. E. Schulz, *B. Napus* Linn. var. *chinensis* (Linn.) O. E. Schulz, *B. oleracea*

Linn.—; in the Philippine Islands—*B. integrifolia* (West.) O. E. Schulz.—.

A. Ovary multi-ovulate (9-45). Pods 1.5-10 cm. long. Beak distinctly conical, sometimes as thick as the pod, often 1- or 2-seeded
  I. Stem-leaves amplexicaul
    1. Flowers not surpassing the buds at flowering
      a. Calyx closed. Petals pale yellow, 1.8-2 cm. long. Pods with undulate margins. Leaves more or less fleshy ... ... 1. *B. oleracea.*
      b. Calyx half-opened. Petals intensely yellow, 0.9-1.8 cm. long. Pods with straight margins. Leaves membranous ... ... 2. *B. Napus.*
    2. Flowers surpassing the buds at flowering ... 3. *B. campestris.*
  II. Stem-leaves sessile or petiolate
    1. Leaves with a plane margin ... ... 4. *B. integrifolia.*
    2. Leaves with a crisp margin ... ... 5. *B. cernua.*

B. Ovary few-ovulate (5-11). Pods 0.8-3 cm. long. Beak very thin, always seedless ... ... 6. *B. nigra.*

1. **Brassica oleracea** Linn. is cultivated in all its numerous varieties all over India. The typical plant is indigenous in Central Europe.

The Cabbage has entered into the Ayurvedic Materia Medica, and is very often prescribed by vaids for a variety of ailments.

The cabbage and its numerous associates are well-known household remedies.

The seeds are diuretic, laxative, stomachic, and anthelmintic. The leaves form a good application in gout and rheumatism. An Irish cure for a sore throat is to tie cabbage leaves round it; and the same remedy is applied in England with hot cabbage leaves for a swollen face.

The red cabbage is most emollient and pectoral. The juice made into syrup, without any condiments, is useful in chronic coughs, and in bronchial asthma. It is considered in France to be highly antiscorbutic.

The leaves of the common white cabbage, when gently bruised and applied to a blistered surface, will promote a free discharge, as also when laid next the skin in dropsy of the ankles. Its juice will cure warts.

Bengal: Kopi—; *Catalan*: Col—; *Chinese*: Kan Lan, Pe Ts'ai, Pao Pao Ts'ai—; *Deccan*: Karam—; *Dutch*: Kool—; *Egypt*: Krumb—; *English*: Cabbage, Colewort, Collet, Sea Cabbage, Wild Cabbage—; *French*: Chou, Navette d'hiver, Rabette—; *German*: Gartenkohl, Kohl—; *Greek*: Krambi—; *Gujerat*: Kobia—; *Hindi*: Band gobi, Karamkalla, Kobi, Kopi—; *Hova*: Laisoa, Laisoamasombika—; *Indo-China*: Cam lam—; *Iraq*: Lahanoh—; *Italian*: Cavolo—; *Kurdish*: Kalam—; *Marathi*: Kholkhol—; *Moldavian*: Curechiu—; *Mundari*: Arakubi, Kubiara, Potomkubi—; *Polish*: Iarmuz, Kapusta—; *Portuguese*: Cauve, Repolho—; *Punjabi*: Band gobi—; *Roumanian*: Varza—; *Russian*: Kapusta—; *Sanskrit*: Dalamalini, Dalasarini, Kebuka, Kechuka, Keluta, Kembu, Kembuka, Pechuka, Pichuni, Polini, Supatra, Swadukanda, Swalpavitapa—; *Spanish*: Berza, Col—; *Swedish*: Kahl—; *Sze-Chwan*: Lien Hoa Pe—; *Tamil*: Gos, Kos—; *Telugu*: Gos.

2. **Brassica Napus** Linn., indigenous in the South Mediterranean region, is cultivated in India.

The root is emollient and diuretic. Its juice is useful in chronic coughs and bronchial catarrh.

The Chinese use the seeds to cure coughs complicated with dyspnoea, and to subdue expectoration due to cold.

Afrikaans: Raap—; *Catalan*: Nap—; *Chinese*: La Pa Tzeu, Lo Pou Tse—; *Danish*: Stekroe—; *Dutch*: Steekraap—; *English*: Coleseed, Navew, Rape—; *French*: Arbi, Chou navet, Navau, Navet—; *German*: Raps, Reps, Ruebsen, Stechruebe—; *Greek*: Bunias—; *Hindi*: Kali sarson, Tori—; *Iraq*: Saljam—; *Italian*: Napo, Navone—; *Malta*: Navone, Neveu—; *Mundari*: Huringmani, Mani, Turimani—; *Persian*: Saljam—; *Polish*: Rzepnica—; *Portuguese*: Nabo—; *Roumanian*: Broajba—; *Russian*: Briukoa, Dikayia Repa, Nyemetskayia Repa—; *Sadani*: Lutumani, Turimani—; *Spanish*: Nabo, Nabo común, Nabo largo—; *Swedish*: Stickrave—; *Uruguay*: Colza, Nabo—.

var. **chinensis** (Linn.) O. E. Schulz is cultivated in India, China, Korea, Japan and Java.

The entire plant is antiscorbutic, arthritic, and resolvent.

The seeds are considered stimulant, stomachic, and laxative.

In Indo-China the leaves and stems are considered to be antidysenteric. The seeds are used in gleet and in difficult parturition.

In Chinese drug shops the plant is represented as dry, round, light-coloured cakes of vegetable matter made from the broken leaves. The cakes have been found to contain a large amount of various vitamins (Hsien Wu).

Annam: Cai—; *China*: Sung—; *English*: Chinese Cabbage—; *Indo-China*: Van dai—; *Japan*: Onuma—; *Malaya*: Pak chai piang—; *Mundari*: Kubi, Risakubi—.

3. **Bassica campestris** Linn. is naturalized in India. In all probability it is indigenous in the mountainous region of the Mediterranean.

The tuberous roots and the seeds are said to be antiscorbutic.

The seeds yield Oil of Colza, which is officinal in Sweden as *Oleum Rapae*.

Arabic: Chardal—; *Betsileo*: Anambe—; *Brahui*: Mashna muli—; *Catalan*: Colinap—; *Danish*: Raps—; *Dehra Dun*: Banga sarson, Sarson—; *Dutch*: Koolzaad—; *English*: Coleseed, Colza, Field Cabbage, Navette, Swedish Turnip, Wild Navew—; *French*: Chou des champs, Chou colza, Navette—; *German*: Rape—; *Hova*: Ananomby, Anantsonga, Nave—; *Italian*: Colza—; *Malta*: Summer Rape, Wild Cabbage, Rapa selvatica, Caulicelli, Liftia—; *Meerut*: Banga sarson, Sarson—; *Mundari*: Piramani—; *Oudh*: Pila sarson—; *Pacific Coast*: Bargeman's Cabbage, Common Navew, Nape, Rutabaga, Summer Rape, Turnip, Wild Navette, Wild Navew—; *Rohilkhand*: Pila sarson—; *Roumanian*: Rapita—; *Russian*: Colza, Surepitsa—; *Sadani*: Sarso—; *Spanish*: Colinabo, Colza, Nabicol, Nabina—; *Uruguay*: Colza, Nabiza, Nabo—.

var. **rapa** (Linn.) Hartm. is cultivated throughout India. The Ayurvedists distinguish two varieties, the red and the white, and consider the white the better of the two.

The seeds mixed with hot water form an efficient counter-irritant poultice. The oil, combined with camphor, forms an efficacious embrocation in muscular rheumatism, stiff neck, etc.; it is used in dengue fever with benefit, and it is rubbed on the chest in bronchitis.

In Indo-China the roots and the leaves are considered stomachic; the ground fresh leaves are applied to abscesses; the seeds are given in colic.

Afrikaans: Raap—; *Annam*: Lu bu, Tron cu—; *Arabic*: Khardaleasvad—; *Bengal*: Kalisarson, Sadarai, Sanshi, Shalgram, Shurshi, Schwetrai, Sursha, Sursi—; *Burma*: Amemniyenzi—; *Canarese*: Kappusasoe, Sarsive—; *Catalan*: Nap de bou, Nap rodo—; *China*: Yun T'ai—; *Cutch*: Surah—; *Deccan*: Kalerayan, Pilerayan—; *English*: Rape, Wild Turnip—; *German*: Reps, Ruebe, Ruebsen, Rurnips—; *Gujerat*: Kalarai, Raira, Sarashire, Sarsawa—; *Hasara*: Dakubi—; *Hindi*: Bangasarson, Baralai, Dain, Dainlai, Jadiya, Jariya, Kalerai, Kalisarson, Khetiya, Lahi, Lahota, Lai, Laita, Pilasarson, Pilirai, Rararada, Rarasarson, Sarson, Sarsonzard, Shalgham, Shetashirsha, Sursi, Tori, Toriya—; *Indo-China*: Man thanh, Vu than—; *Iraq*: Shalghan—; *Kurdish*: Shailam—; *Lepcha*: Kanyang—; *Malayalam*: Karupakatuka—; *Malta*: Swede—; *Marathi*: Kalamohare, Sherasa—; *Mundari*: Dakobi, Piramani—; *Nagpuri*: Dahakobi, Dahakubi—; *Persian*: Sipandanesiyah—; *Punjab*: Gonglu—; *Quetta-Pishin*: Jamboi—; *Rajputana*: Sarson, Sarsu—; *Sanskrit*: Bhutaghna, Bimbata, Duradharsha, Grahagna, Kadamba, Kadambada, Kadambaka, Kalasarshapa, Katukasveha, Katusveha, Rajakshavaka, Rajika, Rakshitaphala, Sarishapa, Sarshapa, Sidhaprayojana, Sidhartha, Tantubha, Tantuka, Tuverika, Ugragandha—; *Sinhalese*: Kaluabbe, Wal-aba—; *Spanish*: Nabo gallego, Turnep—; *Tamil*: Karuppukkadugu—; *Telugu*: Nallaavalu—; *Uthal*: Sarih—.

4. **Brassica integrifolia** (West) O. E. Schulz is much cultivated in India. It is distributed over the Indo-Malayan region, temperate Eastern Asia, Africa, Madagascar, the West Indies, and South America.

The seeds are warming, sudorific, and a well-known aid to digestion. They are much used in internal congestions, in spasmodic, neuralgic, and rheumatic affections, and in morbid states of the cerebro-spinal system.

In medicine the oil is used as an embrocation and is applied to the skin in eruptions and ulcers.

Bengal: Raisarasha—; *Bombay*: Rai, Rajika, Sarson—; *Canarese*: Sasive—; *China*: Pai Chieh—; *Cutch*: Rai—; *English*: Indian Mustard, Rai—; *French*: Moutarde de l'Inde, Moutarde rouge—; *Gujerati*: Rai—; *Hindi*: Badshahirai, Barirai, Barlai, Gohnasarson, Khasrai, Rai, Sarson, Sarsonlahi, Shahzadarai—; *Indo-China*: Ben, Rau cai, Rau mo, Spey top, Thuy thai—; *Kashmir*: Asur—; *Konkani*: Samsvel—; *Malaya*: Pak kai—; *Marathi*: Mohari, Rayan—; *Mundari*: Rai, Raimani—; *Pacific Coast*: Chinese Mustard, Cosson, Indian Mustard, Russian Mustard—; *Philippines*: Mostaza—; *Portuguese*: Mostarda de India, Mostarda vermelha—; *Sadani*: Rai—; *Sanskrit*: Rajika—; *Sinhalese*: Abba—; *Tamil*: Kadugu—.

5. **Brassica cernua** (Thunb.) Forbes and Hemsley is cultivated in India. It is found in China, Japan, and the West Indies.

The leaves are used in Indo-China as an antidysenteric. They are powerfully diaphoretic.

A decoction of the seeds is given in lumbago, cough, and indigestion.

China: Chieh—; *English*: Black Mustard—; *Indo-China*: Gioi—.

6. **Brassica nigra** (Linn.) Koch is cultivated in India and many other countries.

The leaves and seeds are much used by Hindu and Mahommedan practitioners, who credit them with valuable therapeutical properties.

The dried ripe seed is rubefacient, vesicant, emetic, stimulant, tonic and revulsive.

The seeds act as a digestive condiment, if taken moderately. If swallowed whole they operate as a laxative, and for this purpose are sometimes prescribed in dyspepsia and other complaints attended with torpid bowels.

The flour of the seeds is used in the form of a poultice being a useful and simple rubefacient and vesicant. Mustard poultices prove highly serviceable in cases of febrile and inflammatory diseases, internal congestions, spasmodic, neuralgic, and rheumatic affections. Mustard flour in water is highly recommended as a speedy and safe emetic. It is reckoned as a medicine of great value by the Javanese and the Chinese.

The Meskwaki Indians of Wisconsin grind the seed and use the powder as a snuff to cure cold in the head.

The pure fresh oil is a stimulant and mild counter-irritant when applied externally. As such, it is very useful in mild attacks of sore-throat, internal congestion, and chronic muscular rheumatism.

Mustard seed has been recommended by Sanskrit authors as a cure for snake bite and scorpion sting; but Caius and Mhaskar have shown that it has no antidotal value against snake or scorpion venom.

An alkaloid, sinapine, has been isolated from the seeds; also myrosin, sinigrin, inosite, albumins, gums, and colouring matters.

Arabic: Khardal, Khirdal, Khurdal—; *Bengal*: Baisarisha—; *Bogotá*: Rábano, Rábano de canarios—; *Bombay*: Rai, Sarsan—; *Canarese*: Bilesasive, Karisasive, Sasive—; *Danish*: Senep—; *Deccan*: Raiee, Suroo, Sursoo—; *Dutch*: Mosterd, Zwart mosterd—; *Egypt*: Kabar, Khardal, Khodar, Lifsan—; *English*: Black Mustard, Mustard, True Mustard—; *French*: Chou noir, Moutarde, Moutarde grise, Moutarde noire, Navuce rouge, Sénevé, Sénevé noir—; *German*: Gruener Senf, Hollaendischer Senf, Mustert, Schwarzer Senf, Senf—; *Greek*: Napi, Napia, Sinapi, Sinipi—; *Gujerat*: Kalirai, Rai—; *Hindi*: Aslra, Banarasirai, Ghorrai, Jagrai, Kalirai, Lahi, Makrarai, Rai, Sursu, Suru, Taramira, Tira—; *Iraq*: Khardal—; *Italian*: Senapa, Senapa nera, Senapa vera—; *Konkani*: Sansonv—; *Lepcha*: Kun-rang nok—; *Malta*: Black Mustard, Senapa, Senapa nera, Sinapa, Mustarda seuna—; *Meskwaki*: Fîtciko, makani—; *Pacific Coast*: Black Mustard, Brown Mustard, Kerlock, Red Mustard—; *Persian*: Sarshaf—; *Polish*: Gorczyka—; *Portuguese*: Mostarda, Mostardeira—; *Potenza*: Lassand—; *Prairie Potawatomi*: Tcotca'mosîkûn—; *Reggio*: Senva—; *Roumanian*: Mustar—; *Russian*: Gortchiza ; *Sanskrit*: Asuri, Atitikshva, Jwalanti, Jwalatprabha, Katuasuri, Krimika, Krishnasarshapa, Krishnika, Kshava, Kshavaka, Kshudhabhijanana, Kshujjanika, Kshutabhijanaka. Kshutaka, Madhurika, Raji, Rajika, Raktasarshapa, Raktika, Sarshapa, Tikshnagandha—; *Sind*: Ahor, Kali sursoon, Suraj—; *Sinhalese*: Ganaba, Kalu-aba—; *Spanish*: Mostaza—; *Swedish*: Senap—; *Tamil*: Chirukadugu, Kadugu—; *Telugu*: Avalu—; *Treviso*: Colzat—; *Urdu*: Rai—; *Uruguay*: Mostacilla negra, Mostaza negra—; *Verona*: Ravenele—.

CARDAMINE.

The genus includes 100 cosmopolitan species, natives of temperate and cold regions, especially of Europe and Western and Central Asia.

The plant is bitter and antiscorbutic. The flowers are diuretic, useful in chorea and asthma.

The following are used medicinally in Europe—*C. alpina* Willd., *C. amara* Linn., *C. asarifolia* Linn., *C. gelida* Schott., *C. hirsuta* Linn., *C. impatiens* Linn., *C. parviflora* Linn., *C. pratensis* Linn., *C. resedifolia* Linn., *C. sylvatica* Linn., *C. trifolia* Linn.—; in Indo-China—; *C. hirsuta* Linn.—; in Northern America—*C. pratensis* Linn.—.

A. Petals linear, erect, very minute, white, often absent ... 2. *C. impatiens.*
B. Petals spreading, 3 times as long as the sepals ... 1. *C. pratensis.*

1. **Cardamine pratensis** Linn. is found in Kashmir. It is distributed to Northern and Western Asia, Europe, Abyssinia, and Noth America.

The plant is considered to be stimulant, diaphoretic, and diuretic.

In some parts of Europe the plant is used in the treatment of nervous affections. In Cornwall the flowering tops have been employed for the cure of epilepsy throughout several generations with singular success; though the use of the leaves only for this purpose has caused disappointment.

The seeds contain myronic acid.

Catalan : Creixans de prat, Creixens de prat— ; *Dutch* : Gemeen schuimblad, Koekocksbloem, Pinksterbloem, Weidekers— ; *English* : Apple-pie, Bird's-eye, Bogspinks, Bonny-Bird-Een, Bread-and-Milk, Canterbury Bells, Cuckoo's Bread, Cuckoo-flower, Cuckoo-pint, Cuckoo's Shoes and Stockings, Gilliflower, Gookoo-buttons, Headache, Lady Flock, Lady's Glove, Lady's Smock, Lamb Lakins, Lucy Locket, May Blob, May Flower, Milkgirl, Milk Maids, Paigle, Pigeon's Eye, Pink, Shoes and Stockings, Smell Smocks, Spink, Whitsuntide— ; *French* : Bec à l'oiseau, Bouquet au coup, Cardamine, Cardamine des prés, Cresson amer, Cresson élégant, Cressonnette, Cresson des prés, Cresson sauvage, Passerage sauvage, Petit cresson aquatique— ; *German* : Fleischblume, Gauchblume, Kuckucksschaumkraut, Schaumkraut, Schluesseblume, Wiesenkresse, Wiesenschaumkraut— ; *Greek* : Kardamini, Sisymbrion eteron— ; *Italian* : Cardamantina, Cardamina, Crescione pratense, Nasturzio salvaggio— ; *Languedoc* : Creissouneto, Creissoun de prat— ; *Moldavian* : Stupitul cuerlui— ; *Polish* : Aengkrasse— ; *Roumanian* : Pascele calului, Scuipatul cucului, Spumeala— ; *Russian* : Kress, Serdechnik— ; *Spanish* : Berros de prado, Mastuerzo de prado, Mastuerzo pratense—.

2. **Cardamine impatiens** Linn. occurs in the temperate Himalaya from Kashmir to Sikkim, at 5,000-12,000 feet. It is distributed to Afghanistan, temperate Asia and Europe.

The plant is stimulant and diuretic.

English : Mountain Bitter Cress, Narrow-leaved Bitter Cress.

CAPSELLA.

The genus consists of 4 species, natives of temperate and subtropical regions.

Capsella Bursa-pastoris Medik. is a weed of cultivation; it is found in temperate India in cultivated places.

Plant astringent; seeds stimulant. The herb and its seeds were employed in former times to promote the regular monthly flow in women.

Apparently the uses of the plant are unknown in India.

It has been used in English domestic practice from early times as an astringent in diarrhoea; it was much used in decoction with milk to check active purgings in calves.

A well-known popular remedy in Europe and North-America. It is of prompt use to arrest bleedings and floodings, when given in the form of a fluid extract; and it may be considered a most reliable medicine for staying fluxes of blood. The fluid extract of the herb is also given for dropsy as a diuretic.

The Menomini of Wisconsin use the plant as a cure for poison ivy; the plant is steeped, and the water when tepid is used as a wash.

In Bogota the herb, and more particularly the inflorescence, is considered a cure for blennorrhagia.

In Tongking the seeds are given in troubles of the chest; the whole herb when fresh is used as an hemostatic.

Extracts of Shepherd's Purse have been used as substitutes for ergot. They have been asserted to contain acetylcholine, choline, and possibly tyramine, as well as fumaric acid and inositol; but, according to Wasicky (*Ber. deutsch. Pharm. Ges.* 1922, 32, 142), plants free from fungoid infection are devoid of active constituents.

Baluchistan: Halaku—; *Catalan*: Bossas de pastor, Bosses de pastor, Sarronets de pastor—; *Chinese*: Ch'i—; *Colombia*: Calzoncitos, Pan y quesito—; *Dutch*: Herderstaschje—; *English*: Bad Man's Oatmeal, Blind-weed, Case-weed, Clapper Pouch, Cocowort, Fat Hen, Lady's Purse, Mother's Heart, Naughty Man's Plaything, Pepper-and-Salt, Pepper-and-Shot, Pick Pocket, Pick Purse, Pick-your-mother's-heart-out, Poor Man's Permacety, Poor Man's Pharmacetty, Purse, Rattle Pouch, Sanguinary, St. James's Wort, Shepherd's Bag, Shepherd's Pouch, Shepherd's Purse, Shepherd's Scrip, Shepherd's Sprout, Tooth-wort, Toywort, Ward-seed, Witches' Pouchers—; *French*: Bourse à berger, Bourse à curé, Bourse de capucin, Bourse à Judas, Bourse à pasteur, Bourserette, Boursette, Capselle, Fleur de Saint Jacques, Houlette, Malette, Malette à berger, Millefleur, Molette, Molette de berger, Molette des pasteurs, Moufette, Moutarde de Mithridate, Moutarde sauvage, Tabouret, Thlaspi—; *German*: Bauensent, Beutelschneiderkraut, Blutkraut, Brillenkraut, Daxenkraut, Gaensekresse, Geldbeutel, Grischel, Groeschelkraut, Herzelkraut, Hirtentaeschel, Hirtentaeschlein, Hirtentasche, Klaffer, Klapperkraut, Kleep, Kuespelkraut, Lapatekrokt, Muenselkraut, Nadeldieb, Saeckelkraut, Schaeferkraut, Schedelkraut, Schinken, Taeschelkraut, Taschenblume, Taschendieb, Taschenkraut, Voegelikraut—; *Harboi Hills*: Chambraka—; *Indo-China*: Te, Te thai—; *Irish*: Clappedepouch—; *Italian*: Borsacchina, Borsa di pastore, Borsapastore, Erba raperina, Millefiori—; *Malta*: Shepherd's Purse, Borsacchina, Borsa di pastore, Gargir il gemel—; *Menomini*: Wisakipûko'sa—; *Roumanian*: Buruiana de figuri, Buruiana viermelui, Iraba rosie, Pungulita, Tascuta ciobanului, Tascutita, Traista ciobanului—; *Russian*: Pastushiya sumka—; *Spanish*: Bolsa de pastor, Botella, Hierba del cangrejo, Hierba del carbonero, Mastuerzo macho, Paniquesillo, Pan y quesillo, Zurrón de pastor—; *Tongking*: Dinh lich, Dinh luc—.

CHEIRANTHUS.

The genus includes 20 species, natives of the Mediterranean region, Central Europe, the Himalayan region, and North America.

C. Cheiri Linn. is the only therapeutically active species. Its flowers are officinal in Portugal.

Cheirianthus Cheiri Linn. is cultivated in Indian gardens.

The seeds are tonic, diuretic, expectorant, stomachic, aphrodisiac; good in dry bronchitis, fevers, and injuries to the eye (Yunani).

The flowers, said to be cardiac and emmenagogue, are used in paralysis and impotence. They are boiled in olive oil; and this prepared oil is much used for enemata.

The dried petals are much used in Upper India as an aromatic stimulant.

The *seeds* are also used as an aphrodisiac.

An alkaloid, cheirinine, has been isolated from the leaves and seeds. The seeds contain cheiroline, which appears to exist in the plant as a glucoside. Quercetin has been isolated from the colouring matters of the flowers.

Bengal: Khueri—; *Catalan*: Violer groch—; *Dutch*: Muurbloem—; *Egypt*: Manthur—; *English*: Banwort, Bee Flower, Bleeding Heart, Blood Wall, Bloody Warrior, Cherisaunce, Chevisaunce, Churl, Geraflour, Gilly-flower, Handflower, Heartsease, Jacks, Jeroffleris, Jilliver, July Flower, Keyry, Sweet William, Wallflower, Wallstock-gillofer— ; *French* : Bâton d'or, Carafée, Casse col, Coquardeau, Giroflée, Giroflée jaune, Giroflée des murailles, Giroflée des murs, Giroflée suissard, Murayer, Murer, Rameau d'or, Ravenelle jaune, Violette giroflée, Violier jaune— ; *German* : Gelbveiglein, Goldlack, Handblume, Lack, Lackviole, Gelbe Levkoje, Gelbe Viole— ; *Hindi* : Lahurishubu, Todrisurkh— ; *Iraq* : Shabbo asfar— ; *Italian* : Violaciocca gialla, Viola gialle— ; *Languedoc* : Girouflado fero, Granié— ; *Malta* : Wallflower, Violaciocca gialla, Gizi safra— ; *Portuguese* : Goivo amarelho, Violeta amarelha— ; *Punjab* : Todrisrafarmani, Todrisiyah, Todrisurukh— ; *Roumanian* : Micsunea— ; *Russian* : Jeltofiol, Levkoi— ; *Sind* : Todrisiyah, Todrisurkh— ; *Spanish* : Alhelí amarillo— ; *Urdu* : Todrisurkha—.

COCHLEARIA.

The genus consists of 20 species, natives of Northern temperate and Asiatic regions.

Acrid, bitter, antiscorbutic herbs.

The following species are used medicinally in Europe—C. *armoracia* Linn., *C. officinalis* Linn.— ; in Brazil—*C. armoracia* Linn.— ; North America—*C. officinalis* Linn.

Cochlearia flava Ham. is found in the Gangetic valleys from the Punjab to Bengal.

The plant is used as a febrifuge in Bihar.

CRAMBE.

The genus includes 20 European and temperate Asiatic species; some of them distributed to Polynesia and Patagonia.

In Europe *C. hispanica* Linn. and *C. maritima* Linn. are considered specifics against scrofula.

Crambe cordifolia Stev. is found in Kashmir and Baluchistan, whence it spreads to Afghanistan, Persia, and the Caucasus.

At Hindubagh, in Baluchistan, the plant is used as a cure for itch.

Baluchi : Pilgosch— ; *Harnai* : Nawarra— ; *Hindubagh* : Pashai, Skharyae, Skhrai— ; *Khwas* : Naghour— ; *Kila Saifulla* : Pursail— ; *Nushki* : Pilgosch— ; *Waziri* : Navgra—.

DESCURAINIA.

The genus numbers 43 species; most of them inhabit the cold and temperate regions of the whole of America; some are found in Asia, Europe and Macronesia.

D. sophia (Linn.) Webb. is used medicinally in Europe and in the United States of America.

Descurainia sophia (Linn.) Webb. (=*Sisymbrium Sophia* Linn.) occurs in India from Kashmir to Kumaon up to 14,000 feet, in the Eastern Himalaya, the Salt Range, Peshawar and Baluchistan. It is distributed to Afghanistan, Persia, Mesopotamia, the Mediterranean region, Central Europe, arctic and subarctic Europe, China, Japan, Central Asia. The plant has run wild in South Africa, North and South America, and New Zealand.

The flowers and leaves are astringent and antiscorbutic. An infusion of them is a popular remedy in Spain.

In China and Malaya the drug is regarded as demulcent. laxative, and febrifuge.

In Baluchistan the seeds mixed in syrup are swallowed as a cure for fever. On the Pab Hills in Jhalawan the plant is used as a febrifuge.

In the United States of America the herb is used externally in indolent ulcers, and the seeds are given internally in worms, calculus complaints, etc.

The juice, mixed with an equal quantity of honey or vinegar, has been recommended for chronic coughs and hoarseness, and ulcerated sore-throats. A strong infusion of the herb has proved excellent in asthma, and the seeds formed a special remedy for sciatica.

Arabic : Khubah, Robesetti— ; *Catalan* : Herba de la sabiduria, Herba de Santa Sofia— ; *Chinese* : T'ing Li— ; *English* : Flixweed, Fluxweed— ; *French* : Argentine rouge, Herbe des chirurgiens, Herbe de la sagesse, Herbe de sainte Sophie, Mort aux vers, Moutarde de chien, Rhubarbe des paysans, Sagesse des chirurgiens, Sisymbre sophie, Sophie des chirurgiens, Thalictre des marchands, Thalictron, Thalictron des boutiques— ; *German* : Besenkraut, Feinblaetrige, Rauke, Schuttrauke, Sophienkraut, Sophienrauke, Wurmkraut— ; *Harboi Hills* : Rush— ; *Hindi* : Khubkallana— ; *Indo-China* : Bo nuong cao— ; *Jhalawan* : Rush— ; *Kalat* : Rush— ; *Kirani* : Khashir— ; *Malaya* : Tien theng yan, T'ing li yen— ; *Mastung* : Rush— ; *Pab Hills* : Rush— ; *Persian* : Khakshi— ; *Pishin* : Khakshir— ; *Quetta* : Khakshir, Khashir— ; *Spanish* : Ajenjo de Serifo, Hierba de los cirujanos, Hierba de la sabiduria, Serifio absintio, Sofia de los cirujanos— ; *Teheran* : Towdri— ; *United States* : Flax weed— ; *Urdu* : Khakshir—.

DRABA.

This genus includes 150 species; natives of the northern temperate, arctic, and alpine regions, and of the Andes of South America.

Draba muralis Linn. is found in Kashmir up to 6,000 feet. It extends to Asia Minor, Europe, and North Africa.

The plant is used in Spain as an antiscorbutic.

English : Small Whitlow Grass—.

EROPHILA.

The genus includes 4 species, natives of the Mediterranean region and spread over Europe.

Erophila vulgaris DC. is found in Kashmir at 5,000-6,000 feet. It is distributed to Afghanistan, Western Asia, and Europe.

The plant is considered in Spain as an astringent and vulnerary; it is a popular remedy for the whitlow.

English : Spring Whitlow-grass— ; *French* : Drave—.

ERUCA.

The genus consists of 5 species, natives of the Mediterranean region.

E. sativa Gars. is used medicinally in Europe.

Eruca sativa Gars. is indigenous in the Mediterranean; but is cultivated in many parts of India.

The seeds are vesicant, and the whole plant is considered aphrodisiac.

In Europe the young leaves are used as stimulant, stomachic, diuretic, and antiscorbutic. A strong dose will cause vomiting, and may be taken in the place of ipecacuanha. Powdered, the effect is less strong than that of mustard.

Afghanistan : Mandao—; *Arabic* : Buckl—; *Bengal* : Shwetsursha, Suffedshershi, Swetsarish—; *Catalan* : Ruca—; *Egypt* : 'Afin, Gergir, Gery, Shiltam—; *English* : Dame's Rocket, Dame's Violet, Jamba, Purple Rocket, Rocket, Vesper-Flower, White Rocket—; *French* : Roquette, Roquette cultivée, Roquette des jardins—; *German* : Senfkohl—; *Hadramaut* : Buckl—; *Hindi* : Duan, Taramira, Taranuri, Tira—; *Italian* : Ruchetta, Rucola—; *Kumaon* : Chara, Dua— : *Loralai* : Mulai—; *Malta* : Rocket, Ruchetta. Rucola, Aruca, Eruca—; *North-Western Provinces* : Duan, Lalu, Sahwan, Tara, Taramira, Tira—; *Persian* : Jambeh—; *Punjab* : Assu, Jamnia, Tara, Taramira, Usan—; *Sanskrit* : Bhutaghna, Bimbata, Daradharsha, Grahagna, Kadamba, Kadambada, Kadambaka, Rajakshawaka, Rajika, Rakshitaphala, Sarishapa, Sarshapa, Sidhaprayojana, Sidharta, Tantubha, Tantuka, Tuverika, Ugragandha—; *Sind* : Jambeho, Kalasurson—; *Spanish* : Oruga, Raqueta, Roqueta—.

ERYSIMUM.

The genus number 80 species, natives of the Mediterranean region, and inhabiting Europe and Asia.

Erysimum repandum Linn. is found in Kashmir at 5,000-7,000 feet; it is distributed to Persia, and westwards to Eastern Europe and North Africa.

The plant is used in Spain as an antiscorbutic.

The seeds, when placed in water, become coated with transparent mucilage. In Persia they are given in fever; and externally, in the form of a poultice, to relieve pain in the stomach.

Arabic : Khubah—; *Baluchistan* : Kashir—; *Hamadan* : Tukhm-i-khakhshir—; *Persian* : Khakechi—.

FARSETIA.

The genus includes some 20 Mediterranean species, spread over North Africa, Western Asia, and Northern India.

F. ramosissima Hochst. var. *macrocarpa* Schweinf. is used medicinally by the Moors.

1. An erect rigid shrub. Flowers large. Seeds biseriate ...	1. *F. Jacquemontii*
2. Twiggy, covered with denser and finer, closely appressed pubescence. Flowers small. Seeds uniseriate ...	2. *F. Hamiltonii.*
3. A rigid hoary undershrub. Flowers large. Seeds usually biseriate	3. *F. aegyptiaca.*

1. **Farsetia Jacquemontii** Hook. fil. and Th. is found in Northern India, West Rajputana and Sind, extending to Afghanistan.

The plant has a pleasant pungent taste and is taken as a cooling medicine after pounding. In the Punjab it is considered specific for rheumatism.

Punjab : Faridbuti, Faridmuli, Lathia, Mulei—; *Rajputana* : Kagpilang—.

2. **Farsetia Hamiltonii** Royle occurs in the Punjab, Western Rajputana, Sind and Baluchistan; it extends to Afghanistan, Persia, Arabia and North Africa.

The plant is pounded and taken as a cooling medicine. It is considered specific for rheumatism in the Punjab.

Punjab : Faridbuti—.

3 **Farsetia aegyptiaca** Turra is found in the Punjab. It is distributed to Afghanistan, Arabia, Syria, and North Africa.

In the Punjab the plant is considered specific for rheumatism. It is taken as a cooling medicine after pounding.

Arabic : Djarba, Garba, Garbun, Gjerba, Haifal, Turra—; *Punjab* : Faridburi—.

Isatis.

This genus includes about 50 species, natives of the Mediterranean region, and Central and Western Asia.

Isatis tinctoria Linn. is found in Western Tibet, and is cultivated in many parts of India. It is distributed westwards to Europe and the Canary Islands.

The leaves have been used medicinally in the treatment of jaundice, scurvy, and other ailments; but they are of no value.

California : Ash-of-Jerusalem, Dyer's Weed, Dyer's Woad—; *Catalan* : Herba de Sant Felip, Pastell—; *English* : Dyers' Weed, Dyers' Woad, Woad—; *French* : Gouède, Guède, Guesde, Pastel, Pastel des teinturiers, Vouède—: *German* : Faerber, Waid—; *Italian* : Guado, Isatide, Pastello—; *Roumanian* : Dobrisor, Dobrusor—; *Russian* : Sinilnik, Vaida—; *Spanish* : Añil de Aragón, Hierba pastel, Hierba de San Felipe—.

Lepidium.

The genus includes 100 cosmopolitan species.

The genus is acrid, antiscorbutic, and sternutatory.

The following are used medicinally in Europe—*L. campestre* R. Br., *L. crassifolium* W. K., *L. Draba* Linn., *L. graminifolium* Linn., *L. Iberis* Linn., *L. latifolium* Linn., *L. perfoliatum* Linn., *L. ruderale* Linn., *L. sativum* Linn., *L. virginicum* Linn.—; in West Africa—*L. sativum* Linn.—; in Southern Africa—*L. capensis* Thunb., *L. schinzii* Thel.—; in Brazil—*L. ruderale* Linn.—; in Guiana—*L. virginicum* Linn.—; in North America: *L. medium* Greene.

I. Pods orbicular-ovate, notched at tip, valves winged ...	1. *L. sativum.*
II. Pods transversely oblong, tip entire, valves wingless ...	2. *L. Draba.*
III. Pods elliptic or ovoid, tip entire, valves wingless ...	
1. Leaves fleshy	3. *L. crassifolium.*
2. Leaves not fleshy	4. *L. latifolium.*
IV. Pods elliptic or oblong, tips retuse or notched, valves keeled, wingless or winged at tip only	
1. Valves winged at tip	5. *L. ruderale.*
2. Valves almost wingless	6. *L. perfoliatum.*

1. **Lepidium sativum** Linn. is cultivated throughout India.

The seeds are used by both vaids and hakims on account of their mucilaginous properties. They are prescribed as a laxative, and applied to hurts or sprains as a poultice.

According to Honigberger, the plant in the Punjab was administered in cases of asthma, cough with expectoration, and bleeding piles. The root is used in secondary syphilis and tenesmus.

According to Bellew, the seeds are also considered to be galactagogue in the Punjab, and are administered after being boiled with milk, to cause abortion. O'Shaughnessy found the drug to answer as a gentle and warm aperient.

The leaves are mildly stimulant and diuretic, serviceable in scorbutic diseases.

The seeds are a popular Hausa medicine; preparations are made both for internal and external use. The chief medicinal use is for rheumatic pains and swellings, the seeds crushed and mixed with water as a draught or made into liniments; also a dressing for sores in camels and horses. They are also given for diarrhoea and dysentery.

Afghanistan: Tara tezak—; *Arabic*: Habb-er-reshad, Habrasjat, Half, Harfulabaz, Hurf, Jarjir, Reschad—; *Bengal*: Alevarie, Alleevree, Halim—; *Bombay*: Ahaliva, Asalia—; *Bornu*: Karabou—; *Burma*: Mongnyin, Samungni—; *Canarese*: Allibija, Kurutige—; *Catalan*: Enciamet de caputxi, Herba de la fluxió, Morritort, Murissa—; *Deccan*: Halim—; *Egypt*: Habb-er-reshad, Reshad—; *English*: Common Cress, Garden Cress, Passerage, Pepperwort, Town Cress—; *French*: Anitor, Cresson alénois, Cresson des jardins, Cresson de terre, Nasitar, Nasitor, Nasitort, Passerage cultivée—; *Fulani*: Takere fondu—; *German*: Gartenkresse, Kresse, Pfefferkraut—; *Gujerati*: Asalio, Halim—; *Hausa*: Labsur, Lausur—; *Hindi*: Chansur, Chaunsar, Halim, Halon, Hurf, Malavan, Tara, Tezac—; *Iraq*: Rashad—; *Italian*: Lepidio, Nasturzio—; *Kano*: Lausuru—; *Kanuri*: Lapsur—; *Kaisina*: Lafsu—; *Languedoc*: Cercoucello—; *Malta*: Garden cress, Agretto, Crescione inglese, Habberxa—; *Marathi*: Ahliva—; *Mundari*: Camcur, Cancur, Ilicamcur—; *North-Western Provinces*: Halang, Halim—; *Persian*: Rukhame-ispanda, Tereh tizec—; *Portuguese*: Mastruco—; *Punjab*: Halim, Halon, Shargundei, Tezak—; *Sanskrit*: Ashalika, Bhadra, Chandrashura, Chandrika, Charmahantri, Darakrishna, Drighabija, Kalamesha, Karavi, Nandini, Pashumehankarika, Raktabija, Raktaraji, Sidhaprayojana, Suvasura, Vasupreshpa—; *Sind*: Ahree, Ahreo, Assaria—; *Sokoto*: Lafsur—; *Spanish*: Berro de jardin, Malpica, Mastuerzo, Mastuerzo hortense—; *Tamil*: Aliverai—; *Teheran*: Tukhm-shahi—; *Telugu*: Adalavitulu, Adeli, Adityalu, Adiyalu—; *Urdu*: Halim—; *Waziristan*: Halayo—; *Yemen*: Half—; *Zaria*: Lafsur—.

2. **Lepidium Draba** Linn. is found as a weed of cultivation in the Punjab. It occurs in Persia, Mesopotamia, Caucasus, Europe, and the Mediterranean region.

The plant is said to possess antiscorbutic properties; and to control bleeding, if used raw.

In Loralai the seeds are used as a cure for flatulency, seven or eight being taken at a time.

In Waziristan it is used as a stomachic and tonic. In Europe as an antiscorbutic.

Afghanistan: Bijindak—; *Arabic*: Neffélé—; *Baluchi*: Garbust—; *Brahui*: Garbust—; *Catalan*: Capellans, Palitra—; *English*: Hairy Cress, Hoary Cress—; *French*: Drave—; *Hindi*: Bajindak—; *Iraq*: Jinaibrah, Qunaibrah—; *Ispahan*: Montchih—; *Jhalawan*: Garbast—; *Kalat*: Garbust—; *Kila Saifulla*: Buska—; *Kohlu*: Halia—; *Loralai*: Buski—; *Malta*: Hoary Cress, Cocola, Lattona—; *Mushki*: Garbast—; *Pishin*: Bushka—; *Quetta*: Bushka, Busk—; *Spanish*: Lepidio drava—; *Tabriz*: Khili-wili—; *Tasmania*: Hoary Cress, White Weed—; *Waziri*: Bashka—; *Zhob*: Bushka, Buska—.

3. **Lepidium crassifolium** W. K. is found in Baluchistan and the Oriental region, spreading over to Europe.

The plant is employed as a rubefacient in rheumatism. The seeds are prescribed internally in rheumatism and dropsy.

4. **Lepidium latifolium** Linn. is found in Kashmir. It is distributed to Northern and Western Asia, Europe, and North Africa.

The plant is depurative and antiscorbutic. It is used as a resolvent in skin diseases.

Catalan: Herba de la fluxió, Morritort bort, Morritort salvatge, Piperotis—; *English*: Cress, Dittander—; *French*: Passerage à larges feuilles, Grande passerage—; *German*: Breitblaeterige Kresse, Pfefferkraut—; *Italian*: Mostardina, Peperella—; *Ladak*: Gonguch—; *Portuguese*: Herva pimenteira, Herva serra, Lepidio—; *Spanish*: Lepidio, Lepidio de Plinio, Mastuerzo mayor, Piperitas, Piperitis—.

5. **Lepidium ruderale** Linn. is found in Kashmir at 7,000-13,000 feet. It extends through the Oriental region to Europe. It also occurs in Australia.

The plant is used in impetigo.

Brazil: Mastruco, Menstruco—; *English*: Narrow-leaved Pepperwort—; *Tasmania*: Narrow-leaved Cress—; *Uruguay*: Yuyo de resfrio.

6. **Lepidium perfoliatum** Linn. is found in Baluchistan and Afghanistan, whence through the Oriental region it extends to Southern Europe.

In Europe this plant is popularly believed to be a useful antiscorbutic.

MATTHIOLA.

This genus includes 50 species of the Mediterranean region, inhabiting Europe, South Africa, and the Western Himalaya.

The leaves of the following species were formerly used as emmenagogues in Europe—*M. incana* R. Br., *M. tristis* R. Br., *M. varia* DC.—.

Matthiola incana R. Br. is indigenous in the Mediterranean region and in Western Europe; it is cultivated in Indian gardens.

The Mahommedan authors distinguish between three kinds of seeds; yellow, red, and white; but in practice no distinction seems to be made between them. They are all considered bitter, tonic, diuretic, expectorant, stomachic, aphrodisiac; good in dry bronchitis, fevers, and injuries to the eye.

The seeds are used in infusion in cancer; mixed with wine they are given as an antidote to poisonous bites. In the Punjab and in Sind they are reckoned aphrodisiac.

Mhaskar and Caius have shown experimentally that the seeds are not an antidote to snake venom.

Arabic: Bajar-ul-kumam, Manthur—; *Catalan*: Violé comú—; *Egypt*: Kheyly, Manthur, Manthur madbag—; *English*: Gilliflower, Hoary Stock, Queen Stock, Stock—; *French*: Mathiola—; *German*: Winter Levcofe—; *Indo-China*: Tu la lan hoa—; *Iraq*: Shabbo—; *Malta*: Queen's Stock, Stock, Violaciocca, Gizi—; *Persian*: Todri—; *Punjab*: Todri liba, Todri safed—; *Sind*: Todri safed—; *Spanish*: Aleli encanecido—; *Urdu*: Todri safed—; *Uruguay*: Aleli—.

MORICANDIA.

The genus consists of 10 Mediterranean species.

Moricandia tortuosa Hook. fil. and Th. occurs in the salt plains of the Punjab, west of the Indus.

A decoction of the flowers is rubbed on for eczema in Waziristan.

NASTURTIUM.

The genus consists of 50 cosmopolitan species.

The plant is diuretic, stimulant, and antiscorbutic. The seeds are mildly laxative.

The following are used medicinally in Europe—*N. fontanum* Aschers., *N. palustre* DC., *N. sylvestre* R. Br.—; in La Reunion—*N. fontanum* Aschers.—; in Madagascar—*N. barbareaefolium* Baker, *N. fontanum* Aschers.—; in China—*N. montanum* Wall.—; in Indo-China—*N. fontanum* Aschers., *N. indicum* DC.—; in Brazil—*N. fontanum* Aschers.—; in North America—*N. curvisiliqua* Nutt., *N. fontanum* Aschers., *N. palustre* DC.—.

1. Aquatic, stem creeping and floating ... ... 1. *N. fontanum.*
2. Stems weak, suberect, smooth, slightly hairy ... 2. *N. palustre.*
3. Erect, rough-hairy or sometimes glabrous annual ... 3. *N. indicum.*
4. An annual much resembling *N. indicum* but less robust with larger, smoother, less divided leaves ... 4. *N. montanum.*

1. **Nasturtium fontanum** Aschers. is found in many hill stations, in the Punjab, Waziristan, Baluchistan; and thence to Afghanistan, temperate Asia and Europe.

The fresh plant is widely known for its antiscorbutic and stimulant properties. It is used in Brazil in troubles of the chest.

Amarah : Kobani—; *Brazil* : Agriao—; *Catalan* : Creixans, Creixens, Gredas, Morritort d'aigua—; *Deccan* : Lutputiah—; *Dutch* : Water-kers—; *Egypt* : Gorrat-el-aïn—; *English* : Shamrock, Stertion, Water-cress—; *French* : Cailli, Cresson, Cresson aquatique, Cresson d'eau, Cresson de fontaine, Cresson officinal, Cresson de ruisseau, Nasitord, Santé du corps—; *German* : Braunkersch, Brunnenkresse, Kersche, Quellranke, Wasserraute, Wassersenf, Wiesenkresse—; *Greek* : Sisymbrion—; *Hindi* : Deskandar—; *Hova* : Anandrano—; *Irish* : Biolar—; *Italian* : Agretto—; Crescione, Nasturzio, Sisimbrio, Sisimbro—; *Malta* : Water-cress, Crescione d' acqua, Cresciuni, Sija—; *New-Zealand* : Kowhiti-whiti—; *North-Western Himalayas* : Piriyahalim—; *Portuguese* : Agriao—; *Provençal* : Creiso—; *Roumanian* : Brancuta, Cardama de izvor, Hrenita, Nasturel—; *Russian* : Kress—; *Sinhalese* : Kakutupala—; *Spanish* : Berro, Berro común, Berro de fucute, Mastuerzo acuatico—; *Swedish* : Kiaellkrasse—; *Waziri* : Dalamira, Thermera—.

2. **Nasturtium palustre** DC. occurs in North-Western India, the temperate Himalaya up to 10,000 feet, Assam, and Bengal; it is spread over the temperate regions of both hemispheres.

The fresh plant possesses the antiscorbutic properties of the genus.

China : T'ing Li—; *Egypt* : Manthur, Mufrad—; *New South Wales* : Native Cabbage—; *Pacifiic Coast* : Marsh Cress, Marsh Yellow Cress—.

3. **Nasturtium indicum** DC. is found throughout India in wet places from Ceylon to Kashmir and Mishmi, Bengal, Assam, Chittagong, Tenasserim, Malay Peninsula. It extends to Malaya and China.

In Indo-China the plant is considered diuretic, stimulant, and antiscorbutic. The seeds, which are said to be laxative, are also used in the treatment of asthma.

Indo-China: Cai cot xoi, Dirh lich, Lai hoang, Thuy gioi thai—.

4. **Nasturtium montanum** Wall. occurs in North-Western India up to 7,000 feet, in Sikkim, the Khasia Hills, and Burma. It extends to Java, China, and Japan.

The plant has antiscorbutic properties.

China: Han Ts'ai—.

RAPHANUS.

The genus consists of 8 species, mostly Mediterranean.

R. sativus Linn. is used medicinally in Europe, China, Indo-China, Malaya, and the Malay Archipelago.

Raphanus sativus Linn. is found in temperate and warm countries; it is cultivated all over India up to 16,000 feet.

The radish has a hot, sharp, bitter taste; stomachic, binding, anthelmintic; nervine tonic; good in tumours, piles, and all inflammations; useful in diseases of the heart, amenorrhea, hiccough, leprosy, cholera; the juice relieves earache. The flowers are bechic and cholagogue (Ayurveda).

The root is useful for urinary complaints and piles. The seeds are sharp and bitter; laxative, tonic, emmenagogue, carminative; good for the spleen and in paralysis; produce alopecia; mixed with wine they counteract the effects of the bites of snakes and other poisonous animals (Yunani).

Radish seeds are peptic, expectorant, diuretic, laxative, carminative, and corrective. In the Punjab they are considered to be emmenagogue. They are much used in Indo-China by native practitioners.

The roots are used for urinary and syphilitic diseases; they are a reputed medicine for piles and gastrodynic pains.

The juice of the fresh leaves is also used as a diuretic and laxative.

The syrup of radishes is excellent for hoarseness, bronchial difficulty of breathing, whooping-cough, and other complaints of the chest.

These seeds are not an antidote to snake venom (Mhaskar and Caius).

Arabic: Bajrulkijal, Bokel, Boukir, Bou-toum, Fidgel, Figl, Fugel—; *Bengal*: Mula, Muli—; *Bombay*: Mula, Muro—; *Burma*: Monelahmungla, Moula—; *Canarese*: Bili, Mullangi, Mullangiyanne—; *Catalan*: Raba—; *Chinese*: Lai Fu, Tsai Fu Ken—; *Danish*: Redike—; *Deccan*: Mulli—; *Dutch*: Radijs—; *Egypt*: Fidjel—; *English*: Garden Radish, Rabone, Radish—; *French*: Navet rave, Radis, Petit radis, Radis rond, Radis rose, Petite rave, Rave rose, Tendrette—; *German*: Gartenrettich, Rettich, Retting, Sommerrettich, Winterrettich—; *Greek*: Raphanis—; *Gujerat*: Mala, Mura—; *Hausa*: Fijil—; *Hindi*: Fugil, Mula, Muli, Muro, Purabi sarisha, Sweti sarisha, Tora, Toorub—; *Hova*: Radisa—; *Hungarian*: Retek—; *Indo-China*: Cu cai, Lai bac, Lo bac, Lu bu—; *Iraq*: Fujl—; *Italian*: Rafano, Ramolaccio, Ravanello, Ravano—; *Japanese*: Daion—; *Kolami*: Morai—; *Konkani*: Mullo—; *Kurdish*: Tur—; *Languedoc*:

Rabasso, Rafe—; *Malaya*: Lobak, Loh fook—; *Malayalam*: Mullangi—; *Malta*: Radish, Radice, Rafano, Figel, Ravanall—; *Marathi*: Mula, Muri—; *Mongolia*: Laopang, Lobin, Turma—; *Mundari*: Morai, Moroe, Murai, Muroe—; *Mysore*: Magunigadde—; *Nepal*: Mulasinki—; *North-Western Provinces*: Muli—; *Persian*: Tukhmeturub, Turup—; *Philippines*: Rabano—; *Portuguese*: Rabanete, Rabano, Rabao, Rabao negro—; *Punjab*: Muli, Mungra, Taramira—; *Roumanian*: Ridiche—; *Russian*: Radis, Rediska—; *Sanskrit*: Bhumikakshara, Dirghakandaka, Dirghamulaka, Dirghapatraka, Hariparna, Hastidanta, Hastidantaka, Kandamula, Karukandaka, Ksharamula, Kunjar, Kahakanda, Mritakshara, Mulaka, Mulavha, Nilakantha, Rajaluka, Ruchira, Ruchishya, Shankhamula, Shimbiphala, Sita—; *Sind*: Muri—; *Sinhalese*: Rabu—; *Spanish*: Ràbano, Ràbano cultivado, Ràbano negro—; *Swedish*: Raettika—; *Tamil*: Mullangi, Mulinghie—; *Telugu*: Mullangi—; *Tibet*: La phug—; *Turkish*: Turp—; *Urdu*: Mulekebija—; *Uruguay*: Rabanito, Rabano—; *Yemen*: Bokel, Fidyl—.

SISYMBRIUM.

The genus includes 77 species, found chiefly in the temperate regions of both hemispheres.

The genus is diuretic and expectorant.

The following species are used medicinally in Europe—*S. altissimum* Linn., *S. austriacum* Jacq., *S. Irio* Linn., *S. Loeselii* Linn., *S. officinale* Scop., *S. strictissimum* Linn.—; in North America—*S. officinale* Scop., *S. pinnatum* Greene—.

A. Fruiting pedicles as broad as the pod ... ... 2. *S. altissimum.*
B. Fruiting pedicles slender
  1. Pods 3.8-5 cm., erect ... ... 1. *S. Irio.*
  2. Pods 2.5-3.8 cm., slightly curved ... ... 3. *S. Loeselii.*

1. **Sisymbrium Irio**, Linn. is found in Rajputana, Punjab, Peshawar, Baluchistan, and Kohat. It is distributed to Central Asia, Afghanistan, Arabia, the Mediterranean, and Eritrea.

The seed is expectorant and restorative, and used externally as a stimulating poultice.

It is also said to be febrifuge.

In Spain an infusion of the leaves is given in affections of the throat and of the chest.

Arabic: Khubah, silihg—; *Catalan*: Apagallums, Mata-llums—; *Egypt*: Figl-el-gemmal, Harra—; *English*: London Rocket—; *Iraq*: Huwairah—; *Malta*: London Rocket—; *Merwara*: Parjan—; *Persian*: Kharkasi—; *Punjab*: Janglisarson, Maktrusa—; *Sind*: Junglisurson—; *Spanish*: Matacandiles, Oruga leonina, Rabanillo amarillo—; *Urdu*: Khubakalan—.

2. **Sisymbrium altissium** Linn. occurs in Kashmir up to 8,000 feet and in Chitral. It is distributed to Persia, Western Asia, the Mediterranean, and Central Europe.

The leaves and flowers are considered astringent and antiscorbutic.

3. **Sisymbrium Loeselii** Linn. occurs in Kashmir up to 8,000 feet and in Peshawar. It is distributed to Central Asia, Siberia, Western Asia, Central Europe.

The leaves and flowers are given in scurvy and in scrofula.

THLSAPI.

The genus consists of 60 species inhabiting the Northern temperate regions.

Thlaspi arvense Linn. is found as a weed of cultivation throughout the temperate and subalpine Himalaya, ascending to 14,000 feet. It is spread over Europe and Asia, always in cultivated places.

The seeds and the shoots are used medicinally by the Chinese. In Spain the plant is considered astringent and the seeds stimulant.

Catalan : Traspic— ; *Chinese* : Hsi Ming— ; *English* : Mithridate Mustard, Penny Cress, Shepher's Purse— ; *French* : Monnoyère, Tabouret des champs— ; *Italian* : Erba storna— ; *Spanish* : Mostaza salvaje, Talaspico, Tlaspios—.

BOMBAY'S FISHING INDUSTRY.

BY

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FISHERMEN'S STRUGGLE FOR EXISTENCE.

Bombay's pre-eminence as a port and a great commercial centre has tended to obscure from our mind the fact that originally it was nothing but a group of unconnected, mean fishing islets. From such humble origin it has grown to be India's Gateway and foremost port, with ships from all the world calling at its magnificent harbour. The fishing trade, which was its original mainstay, has not, however, kept pace to the same degree with its commercial progress. The trade is still conducted at various spots in the city where it undoubtedly was in days gone by, and this serves as a useful reminder of the former origin of our great city.

The fish landed in Bombay averages 50,000 tons only and yields Rs. 80 lakhs. An idea of the wealth which the harvest of the sea is capable of producing may be had from the example of Japan, where vast revenue is realised from Fisheries (coastal, deep sea, whaling, trawling and fish rearing). The complete figures for 1934 showed a catch of 50,00,000 tons, valued at 3,04,450 million yen (Rs. 2,38,612 millions). This is equivalent to about one-third of the world's sea fisheries. Fish landed in Spain, Great Britain, Australia and France annually is valued at approximately Rs. 53,00,000, Rs. 27,00,00,000, Rs. 1,60,00,000 and Rs. 9,33,00,000 respectively.

Supplies inadequate:—The immense potentialities of a flourishing fishing industry have not yet been realised in our Province. Although there has been a substantial improvement in recent years, the progress is slow. The increasing demand for fish in Bombay is clear evidence of the fact that there is a real and profitable market for the sale of this valuable foodstuff in our city. The supply falls, however, considerably below the demand as a visit to any market will show. Bombay, with its lengthy coast-line of over 1,300 miles, has numerous estuaries, creeks providing natural facilities for fishing, but despite these, the supply is still far from adequate to cope with the demand. Not only during the monsoon when the local supply is practically nil, but even during the fair season, large quantities of fish have to be imported into the city to meet but unsatisfactorily the needs of the people. The result of this scarcity is that fish is frequently not available to many who would otherwise make it a regular item of food.

The main reason why fishing does not occupy the rightful place that is due to it among our country's industries is because the peculiar structure of our society ordains that fishing and the trade in fish must be conducted exclusively by those whose avocation it is by caste. The whole industry is, thus, in the hands of people who belong to the lower strata of our society, with no capital, no education, no initiative and no business capacity. Under such circumstances, it is hardly to be wondered at that the fisheries of the Bombay Province, in common with those of other maritime provinces in India, are undeveloped and that our supply is what may best be described as scanty and unsteady.

Neglected industry:—The general belief that fishing is a mean occupation solely to be pursued by one or two special castes results in restricting fishing to those whom the accident of birth makes it their life's calling. Except for a few individuals, there have been no instances of men of education and capital entering the fishing trade on a large commercial scale. Fisheries, in consequence, have not attracted capital from any of the high caste money-owning classes in this Province, whereas in other maritime countries, the importance of fisheries in the commercial organisation has always been recognised.

The result of conditions obtaining in this country is that the industry is unable to provide, from the meagre resources of the few who pursue the craft, the capital and the driving power necessary to exploit to the fullest extent the ungathered harvest of our teeming seas. The insufficiency of the supply of fish is due to the low catching capacity of our fishing methods and also to our faulty system of distribution. These difficulties are further enhanced by the limited period of the year during which fish is available. Experience has shown, that Bombay has an abundant supply of fish from September to December. These four months represent the peak of the fishing season for Bombay fishermen. Later on from December to June, when enough fish is not available in the immediate vicinity of Bombay, it is brought from distant sites by rail, sailing craft, bus and launches.

Small scale of operations:—Sea fishing in the Bombay Province is conducted on a small scale only. As a rule, fishermen do not go out more than 10 to 12 miles from the shore to fish. Occasionally they go as far as 20 to 30 miles; but the smaller boats do not venture into water deeper than 16 fathoms. Moreover, most of the fish landed by sail boats is caught in huge bag nets which are attached to long stakes planted in the sea bed and it is obviously impossible to fix these stakes in waters more than 12 or 15 miles from the coast owing to the great depth. Our fishermen, owing to the distance of the fishing fields from Bombay and their frail fishing craft, are thus not able to touch more than the bare fringe of the fishing grounds. If fishermen could go further afield and land their catch in Bombay, the result would be many times more satisfactory. There is room for an increase of 50 per cent. in the quantity of fish normally sold in the Bombay markets. The position in the mofussil, so far as supply is concerned is acute, and in several districts fish as an article of diet is more often than not a rare luxury which few can afford. There is no reason why this state of affairs should continue as there are fruitful fishing fields not very far off from Bombay. There is another facility and that is the number of landing sites in Bombay itself, so that the increased supplies could be judiciously landed at appropriate distributing centres.

Landing site and fishing grounds:—Fish is landed at various ports in Bombay both on the East and West side of the island. These places are Arthur Bunder, Sassoon Dock, Bhaucha Dhakka, Chowpathi, Mazagaon, Sewri, Worli, Mahim, Dharavi, etc. By far the bulk of the fish brought to Bombay is landed at Arthur Bunder and Sassoon Dock, both in the Colaba area. These centres have been traditional sites of fishermen's colonies for generations past, and the fishermen have plied their trade there for countless years. The most flourishing colony, where trade is briskest, is undoubtedly Sassoon Dock. It affords a safe and convenient anchorage for the frail fishing craft. Moreover, there are suitable facilities for landing fish here, from whence it is quickly despatched for sale to the markets. The ubiquitous bus is used to transport the fish to the markets. The increasing use of motor vehicles is gradually displacing human labour and the sight of the fisherwomen staggering under a ponderous load, once so familiar in the streets of Bombay, is now becoming increasingly rare. Handcarts are also extensively employed to carry fish from the landing sites to the markets.

Apart from Bombay's own colonies of fishermen, there are also fishing communities at Worli, Chimai, Korah, Danda, Manori, Bhyandar, Bassein, Virar, Kelva, Satpati (near Palghar), Nawapur, Chinchani, Dahanu, etc. The fisher folk at these places fish not only off shore and in creeks but also in the deep sea at a distance of about 12 miles from the coast.

The fishermen of Satpati, it may be added, venture as far as Kathiawar for Pomfrets, although it must be made clear that they do not actually catch fish but merely buy it from the Kathiawar fishermen and bring it to Bombay. These fishermen willingly incur the hazards of a long voyage in their primitive vessels, because they know that the return voyage from Diu to Bombay will be assisted by favourable winds and that their pomfrets, which in February, March and April are not available in Bombay, will then fetch an attractive price in our city.

Fish from places such as Danda, Vesava, Manori, Uttan, Bassein, Palghar, Broach, etc. situated on B.B. & C.I. Railway is invariably brought by train to Bombay and landed at the Grant Road Railway station, whence the B.B. & C. I. Railway vans hurriedly set off with the fish parcels to the various markets. Of the two railways namely the B.B. & C.I. and the G.I.P. Railway, which serve Bombay, it is through the former that fish is imported into Bombay, as this railway runs more or less parallel with the coast. Fish is also imported by steamers from Karachi, Okha in Kathiawar, Veraval and Jamnagar, either in air-proof ice-boxes or ordinary ice-boxes. Had it not been for these imports by rail and steamer, it is certain that the fish caught locally would by no means suffice to meet the large and the constant demand for fish in the city.

It would not be out of place here to describe the various processes from the time the fish is caught till it is sold to the public.

Stages in marketing of fish:—Landing of fish comes first in the natural order of sequence. As soon as the catch is landed, the fishermen's problems begin. This aspect of the fishermen's trade has never been fully explored and explained. The marketing of fish is an elaborate affair in view of the numerous links in the business. The central figures in the picture of the fish trade are undoubtedly the owners of the fishing craft, the fishermen who actually fish, the wholesale fish merchants, the commission agents, fish retailers and lastly the consumers. There are many other actors who make up the full cast, but I shall deal only with the principals and try to show how each one of them hopes to benefit from the landing of a catch of fish.

Some of the fishermen do their own marketing. Their womenfolk carry the fish to the market and retail it there. A large majority of the fishermen are dependent, however, for marketing on wholesale fish dealers. Here, a local dealer acts as a banker. At the beginning of the fishing season merchants enter into contracts with as many fishermen as possible undertaking to buy up their entire catches from time to time at definite fixed prices for different types of fish. These dealers advance the fishermen the money necessary for boats and nets. They also give the fishermen periodic cash advances for incidental domestic expenditure, marriage and death expenses, etc. Some dealers own sail boats which they send out to sea to collect fish from the various fishermen with whom they have entered into a contract and bring it to the landing site. Before the fish is handed over to the collecting boat, the catch is individually counted and made over to the dealers. Accounts are struck up later, after about a week or so, when the fishermen return to port. The accounts are finally settled by the contractor after he has deducted the advance made for the upkeep of boats and nets. Any balance, if outstanding to the fishermen, is then paid to them by the wholesale dealer. These dealers in their turn send the catch to Bombay to the Crawford market to their commission agents, who auction the fish and charge six per cent for their service. At this stage the fish passes into the hands of people who retail the fish in the Crawford market or pass it on to their sub-agents for retail sale in other markets of the city.

Meagre earnings:—Our fishermen have no other source of livelihood than fishing. Their earnings are meagre. If one takes into consideration the months when no fishing is done, owing to the monsoon or to the disappearance of fish from our coast on account of migration, the earnings obtained during the fishing season if spread over the period of a year are reduced to an insignificant figure. Thus in a few months of brisk fishing they must earn for the whole year. Even in the fishing season earnings are far from great, owing firstly to fierce competition and secondly, to the fact that the commodity before it finally reaches the consumer from the boat, passes through many hands the wholesale dealer, the commission agent and the retail vendor. The money obtained by the fisherman, who has incurred all the risks and hazards of his trade, is scarcely a fraction of what the consumer pays the retail vendor. Whether every man who handles the fish makes a big or small profit, or no profit, does not alter the fact that every transaction is to be paid for. The fisherman's catch as it changes hands gets dearer in the process and his legitimate margin of profit is narrowed down by the superfluous intermediate agencies that cumber his trade for their own gain.

An illustration will make this clear. I shall refer specifically to pomfrets, the season for which is from September to November. The wholesale dealer, from whom the consumer eventually gets his supply, pays the fisherman about Re. 1 to Rs. 1-8-0 per *kodi*, —the technical term used in the fishing trade for a lot of 22 fish, but never does the public get pomfrets at an anna each or even at four annas a pair, even the height of the fishing season. Any household that buys fish at this time will confirm the statement that the cook never charges less than six to eight annas a pair. The price of course rises when the pomfret is out of season, and then Re. 1 to Rs. 1-8-0 per pair of pomfrets is not uncommon.

Precarious calling :—Apart from the distributing media which absorb, without much effort, the profit that is readily due to the fishermen the latter have to contend with a number of adverse factors. If foul weather is left out of count, the fisherman has yet other problems. He has no certainty that every trip to the fishing fields will be productive. On a bad day the catch will be small, even an abundant catch may be a mixed blessing. It means a glut on the market for that day, with a corresponding diminution in the prices paid by the wholesale dealer and therefore in the margin of profit. Further, fish have first to be caught and landed, they do not fall into the nests. They have to be tracked and their favourite haunts located. This means time, money and effort. Boats and fishing gear have to be purchased before any fishing can be undertaken. Wear and tear and destruction of gear are heavy, and repairs and replacements take away a large share of the return. It is scarcely to be wondered at therefore that our fishermen lead a hand-to-mouth existence, for they are invariably in debt. Conditions are against them, and even if they want to, they cannot modernise their methods, owing to habitual poverty.

Fishermen's apathy:—The possibilities of the development of the fishing industry in and around Bombay are great, but the reason why no progress has been made is, first, the chronic poverty of our fishermen and secondly, their inveterate disinclination to introduce modern methods. No improvements can be expected as long as they continue to fish in the manner of their forefathers. Our fishermen, it must be admitted, are a conservative community, indifferent to the introduction of new devices. They lag behind only because they have steadily failed to keep pace with the times. The prime necessity is to educate our fishermen to a realisation of the value of adopting modern and improved methods of fishing.

That the seas around Bombay teem with fish, has been abundantly proved by the investigation of the *William Carrick*, the trawler specially brought out by the Bombay Government to survey and locate the fishing grounds in our waters. The work of this vessel showed that just the bare fringe of the fishing grounds is now touched, and that with improved fishing gear, our fishermen could not only venture further afield and augment the yield but also earn greater profit for themselves.

Other main problems confronting the fishing industry are the question of rapid transport, cold storage of the catch and efficient methods of distribution, so that fish reach the market within the minimum time.

Government's help to industry:—The first problem, namely, that of transport has in some measure been tackled by the Government of Bombay, who have successfully demonstrated that there is a fine opening for private enterprise, either for fishermen themselves or others co-operating with them, in the use of launches for the speedy transport of fish. The Bombay Government, in 1933, inaugurated an experiment to popularise the use of motor launches as fish carriers. That the progress of the experiment has been encouraging is evident from the fact that every year since, there has been an addition to the number of vessels. The vessels, of which there are now nine, were originally meant to operate within a radius of about 30 miles from Bombay in order to demonstrate to the fishermen the advantages of launches over sail boats for the rapid carriage of fish.

The launches did not, however, confine themselves to this restricted sphere of operation. They went farther and farther afield, first to Ratnagiri, then to Malwan and so until they now bring fish from Karwar, which is nearly 300 miles from Bombay. The time taken in the round trip to Karwar is about five days. The fish, which is stored in the holds of the vessels in ice, reaches Bombay in excellent condition.

The launches have not only served to demonstrate the advantages of fast mechanical transport. They have also fulfilled another great object; by making available in Bombay a supply of fish at a period of the year when fish was usually not available in sufficiently large quantities to meet the constant demand. The launches have also, incidentally, served to introduce to local consumers types of fish, which, before the operation of the launches along the Konkan coast, were scarcely ever to be seen or even heard of in the Bombay markets. Foremost among these is the mackerel, known in the vernacular as *bangda*. This is a fish of exceptional nutritive value, rich in proteins and fat contents. Since the introduction of the launches the city's supply of fish has been augmented by lakhs of pounds. During the current fishing season these launches brought from the Kanara coast, about 270 miles from Bombay, 15,00,000 lb. of fish.

The success achieved by the Bombay Government's experiment to popularise the use of rapid sea-going transport has stimulated and encouraged capitalists and educated people to come forward and invest in launches. A most encouraging sign! for capitalists, who have so far kept aloof, can do much to develop our fishing industry and help our fishermen, who by their own unaided efforts cannot prosper. The fishing industry occupies a prominent place in most maritime countries of the world. Even Kings and aristocrats support and encourage it. It may not be generally known that the king of the Belgians is the patron of a fishing organization known as the 'Ibis', which owns a number of fishing vessels.

Neglected varieties of fish :—The co-operation of the public is also an essential factor in any scheme to develop the fishing industry. As matters stand at present the public confines its choice of fish to only three or four popular varieties, with the result that other types are usually unsold and converted into manure. A part of the fishermen's catch is thus rendered entirely unremunerative and profitless. Usually about 30 varieties of fishes are landed in Bombay daily, but there is a real demand for only about four or five varieties, namely, pomfrets, *rawas, dara* and *surmai.* Other equally tasty and good fish, such as mackerel, dog fish, sardine, *kupa, koheri, bhing, pala, ghol, akru* are bought by only poor people. Yet the fish bought by the poor are no less tasty or nutritive than those in constant demand by the more well-to-do. The better classes are merely the victims to their own ignorance, and do not know what they are missing.

These neglected varieties could be popularised by the general public widening their usual sphere of choice. The public will not only be extending a non monotonous menu but will also be helping our fishermen to realise a larger return for their arduous and hazardous labours. By increasing the demand for such fish, the public can indirectly stimulate general business throughout the country. With the marketing of bigger catches, the purchasing power of the fishermen will increase.

Fish a health food:—There are several reasons why fish should commend itself as an item of diet. The dietetic value of fish and its superiority over other flesh foods such as meat and game is unquestioned. Centuries ago it was known in a vague way that the eating of fish was conducive to health, but only within comparatively recent years has it been established that the belief had a basis in fact. Scientists and dieticians have examined various fish foods and revealed many startling facts by their investigations and experiments. Some of the oils extracted from the livers and bodies of certain fish are nowadays renowned the world over for their wonderful health-building and curative properties. At the present time, scientists in Canada and elsewhere are conducting intensive studies into the nutritive qualities of fish and every year there is announced some discovery of importance to the health of mankind. Only recently, it was stated that Ling Cod, a Pacific Coast food-fish 'has been found to be one of the richest known sources of insulin'—a substance which is of great value in the treatment of diabetes.

Fish contains a relatively high percentage of protein, the most important constituent of food, but its dietic value is enhanced because of the health-guarding and health-building elements found in it. These factors, combined with the tastiness and ease of digestion make it a food of exceptional value.

Another valuable property in which fish abounds is iodine. This inexpensive drug is so commonly used for the treatment of wounds that we do not realise its great therapeutic value. Iodine is a great prophylactic against such diseases as goitre. Vast areas of land contain almost no iodine at all, and hence iodine does not occur in the flesh of land-living food animals which feed upon them. On the other hand, it is relatively abundant in the bodies of different varieties of fish. Such common fish as cod, haddock, halibut, lobsters, etc., contain, per pound, several times the human body's daily iodine requirements, so that if fish is eaten regularly the body is supplied with the iodine essential to health. Dr. J. F. McClendon, who several years ago was sent to Japan by the Rockefeller Foundation to make an exhaustive study of the diet of the Japanese people, reported that in Japan there is only one case of goitre to every 10,00,000 people. Another very striking observation recorded was that there was no radium in Japan. This is because they have little or no cancer. This new association of no goitre and no cancer in a country where the diets are enormously high in iodine leads one to believe that the goitre-preventing qualities found in sea foods are also valuable preventives for cancer.

Enough has been said to make it abundantly clear that the fisherman is undoubtedly the most conspicuous figure in the picture of the fishing trade, but the public thinks little of him, or of the hardships and difficulties he unmurmuringly undergoes.

The fisherman is entirely an unknown entity to us. His humble personality never comes within our ken. We are practically ignorant of his very existence and this is because we entrust our marketing to a legion of servants. It is true we have no fish markets devoted exclusively to the sale of fish as in other European countries; but this ought not to deter us from visiting the fish-landing sites and learning something of the numerous varieties of fish landed and the conditions under which the trade is pursued. Only thus could we come into more intimate contact with the fisherman. The welfare of the fisherman and his trade is in our own hands. Visits to fish-landing sites can be of immense educative value. The average fish-eater in this country does not know the names of more than half a dozen stock varieties of fish. It is by visiting fish markets and fish-landing sites that we can widen our knowledge of the infinite variety of the denizens of the seas and perhaps kindle among our children an interest in marine fauna, for it is on the younger generation, who will have to deal with the changed conditions of life and food supply that the future prosperity of the industry will eventually depend.

THE HABITS OF THE COMMON EARWIG OF ANNAMALAINAGAR, *EUBORELLIA STALI* (DOHRN).

BY

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To collect material for studying the development of the common South Indian Earwig, I have kept under observation for the past six months a large number of living specimens collected mostly from Annamalainagar and to a small extent from Tanjore and Coimbatore. The observations I have made so far are embodied in this note. Observations on the Indian *Dermaptera* were made by Dr. Annandale (**1**),[1] M. Burr (**2**), and Morgan Hebard (**3**). My observations, as shown below, differ from theirs in certain respects.

In my laboratory the earwigs were placed in slightly moist humus in wide-mouthed jars. They were periodically fed on earthworms, petals of *Hibiscus rosa sinensis,* garden snails, etc.

The natural haunt of *Euborellia stali* (Dohrn) is under stones, dead leaves, and in almost all places in the soil where a certain amount of moisture is present. Like all other earwigs, they burrow in the soil. The insects are nocturnal in habit and do not emerge by day-light. They are not attracted by light. They are alert active creatures, running away, when disturbed, holding their forceps widely opened.

The forceps of earwigs are weapons of offence and defence. Dr. Annandale with reference to *Labidura riparia* Pall., var. *inermis,* Br., remarked as follows :—

'I have never seen an earwig nip another, nor I have been able to induce one to nip my finger' (**1**). But I find that not only does this earwig protect itself with its forceps but it can inflict severe wounds with them. Gadeau de Kerville has shown that the forceps are used as weapons of offence and defence and he has recorded a number of interesting notes on the function of the forceps of the earwigs. 'Gadeau de Kerville was nipped by . . . *Forficula auricularia* so strongly that blood was drawn, and Commander J. J. Walker had the same experience in New South Wales with the largest known earwig *Anisolabis colossea*' (**2**).

Euborellia stali is a small species and is not able to pierce tough skin, but nevertheless when caught it tries to extricate itself, by using its forceps.

Though chiefly carnivorous these earwigs feed freely on vegetable matter. They eat the petals of *Hibiscus rosa sinensis*, of *Thespesia,* and of the rose, also rotten oranges, tomatoes, plantains, etc. They also eat killed garden snails, small soft-bodied insects, dead grasshoppers, dead prawns, earthworms, mutton, eggs of small creatures, etc. Mr. B. Burr fed *Labidura riparia* on blue-bottle flies. They sucked them dry and left the empty skin (**2**). Dr. Annandale noticed that *Labidura riparia*, sometimes carries its prey on its forceps (**1**). I find the forceps are really very useful implements for catching the food and conveying it to the mouth. The earwig attacks and seizes its prey with its forceps and then bending its body to one side, transfers it to its mouth.

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[1] Numbers in thick type within brackets refer to the serial numbers of the various publications listed in the bibliography at the end of the paper.

When these earwigs are placed in large numbers in a single jar they become cannibalistic, the stronger ones eating the weaker. The young are very active and move more quickly than the adults. Green found that *Elaunan bipartitus* (Kirby) 'when handled gave off a pungent odour like that of the Bombardier beetle' (**2**). The species with which this note is concerned did not exhibit the same character.

The sexes can be distinguishd to a certain extent by their size, the shape of the forceps, and the number of segments. Males are smaller in size, and their forceps are more curved than those of the female. The straight and unnotched or entire forceps of the female are heavier in build and stronger than those of the male. There are only 6 abdominal segments in the female while in the male there are 8.

Euborellia stali is neither a household nor a garden pest.

Breeding habits.—To study their breeding habits the earwigs were sorted out in pairs, and placed in separate jars. In mating the male usually backs up to the female and touches her forceps. The female in her turn expands her forceps and comes closer to the male. The male then twists its tail portion and effects a connection tail to tail. In the act of copulation the ventral side of the male is opposed to the ventral side of the female. Copulation usually lasts for about 15 minutes. The female, being stronger, sometimes drags her partner.

My observations in these respects conform to those of de Geer, Lesne, de Bormans and Gadeau de Kerville (**2**).

Oviposition.—I have collected eggs of *Euborellia stali* in the months of November, December, January, February, March, April, June, July and August (i.e., practically all through the year). The female takes about 20 hours to lay the full complement of eggs which are usually about 35 in number, ovoid in shape, white in colour, and small in size. Milton observed 48 eggs laid by a female earwig (**4**). Some species, as several observers have recorded, are known to lay as many as 90 eggs at a time (**2**).

Maternal care.—The female earwig sits over her eggs, and guards them. The male never approaches the brooding female. If the eggs are separated from the mother they are not found to hatch. Mr. and Mrs. Milton observed the same thing in their study (**4**). If disturbed when brooding, the mother takes the eggs one by one in its mandibles and removes them to a safe corner. She cleans them every now and then with her mouth; and, if seriously disturbed, she eats them. If, for instance, the cluster of eggs is scattered, the mother makes no attempt to collect them, but responds by eating them. de Geer in the case of the species observed by him found that the mother picked up all the eggs when scattered in the different parts of the sand-box (2).

Incubation takes about eight days in the case of *Euborellia stali* (Dohrn). In the case of *Forficula auricularia* it is said to be about 16 days (4). The young ones are white in colour, and there is no structural difference between the young and the adult except in size. The active newly hatched young cluster round the mother sometimes sitting on her back. If one of her young tends to stray the mother seizes it in her mandibles and restores it to the family circle. The mothers' solicitude for her brood lasts for nearly 3 days after hatching, then she leaves them to fend for themselves. I have not as yet been able to determine the number of moults passed through before a young becomes an adult.

Enemies.—At night, when the earwigs came to the surface of the soil in the jar, they were attacked by lizards and cockroaches; and I actually found a lizard eating a large number of my captives. Cockroaches usually attack the smaller ones. Ants sometimes invade the jars in large numbers and do considerable damage. Some of my earwigs were also infected with ticks. The ticks are ectoparasites, and many may be found adhering to the body of a single earwig. The whole metabolism of the victim is affected and it usually dies after two or three days of infection.

I am highly thankful to Mr. Hemsingh Pruthi, Imperial Entomologist, New Delhi, for his identification of my specimens as *Euborellia stali* (Dohrn). He was also kind enough to suggest some literature for my study of earwigs.

I am also thankful to Mr. R. V. Seshaiya, Lecturer in Zoology, Annamalai University, under whom I have been carrying on my study on Dermaptera.

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EARTH-EATING AND SALT-LICKING IN INDIA

BY

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Analyses XLVIII—LI

XLVIII—*Soil from Salt-Lick*

Serial No. 107.

Locality –Begur Reserve, about 15 miles from Manantoddy, Wynaad.

Collected and sent by—D. Mc D. Currie, Esq., District Forest Officer, Wynaad.

Hard buffy lumps. Powder gritty and soapy to the touch.

Minerals	26·55	per cent.
Clay	7·65	,,
Sand	52·58	,,
Organic debris	1·81	,,
Moisture	3·64	,,
Fine Earth (20 mesh sieve)	69·800	,,
Insoluble in nitric acid	42·550	,,
Magnesia (MgO)	0·330	,,
Lime (CaO)	0·944	,,
Alumina (Al_2O_3)	3·546	,,
Silica (SiO_2) soluble	11·360	,,
Phosphorus (P_2O_5)	0·303	,,
Ferric oxide (Fe_2O_3)	7·514	,,
Moisture and organic matter	3·638	,,

Remarks: 1. The soil contains traces of sodium, potassium, chlorine, manganese and carbon dioxide, 0·043 per cent. water-soluble inorganic matter, and 0·090 per cent. water-soluble organic matter.

2. The lick is a little nullah down which there is a tiny stream flowing during the south-west monsoon. It dries up very quickly.

The Reserve borders Coorg in the North, and Mysore on the East. The forest is good deciduous forest consisting mainly of teak, *Terminalia tomentosa*, *Lagerstroesmia*, and *Pterocarpus marsupium*. The rainfall is about 70 inches. The country is undulating and in parts hilly. The elevation is about 2,700 feet.

3. The lick is much visited by sambhur and chital.

XLIX. *Common Earth*

Serial No. 108.

Locality—Begur Reserve, about 15 miles from Manantoddy, Wynaad.

Collected and sent by—D. Mc D. Currie, Esq., District Forest Officer, Wynaad.

Friable lumps of black soil. Powder soft.

Minerals	24·50 per cent.
Clay	21·70 ,,
Sand	36 63 ,,
Organic debris	1·52 ,,
Humus	9·16 ,,
Moisture	3·78 ,,

Fine Earth (20 mesh sieve)	71·960 per cent.
Insoluble in nitric acid	43·060 ,,
Soda (Na_2O)	0·390 ,,
Potash (K_2O)	0·342 ,,
Lime (CaO)	0·451 ,,
Alumina (Al_2O_3)	2·966 ,,
Silica (SiO_2) soluble	10·030 ,,
Phosphorus (P_2O_5)	0·275 ,,
Ferric oxide (Fe_2O_3)	3·553 ,,
Moisture and organic matter	9·984 ,,

Remarks : 1. The soil contains traces of magnesium, sulphur, chlorine, manganese and carbon dioxide, 0·060 per cent. water-soluble inorganic matter, and 0·105 per cent. water-soluble organic matter.

2. The earth was collected from a spot about 200 yards away from Salt-lick No. 107.

L. *Soil from Salt-Lick*

Serial No. 109.

Locality—Begur Reserve, about 15 miles from Manantoddy, Wynaad.

Collected and sent by—D. Mc D. Currie, Esq., District Forest Officer, Wynaad.

Hard lumps of greyish earth ; fracture mottled white and brown. Many rootlets. Powder buffy, soft.

Minerals	11·49 per cent.
Clay	35·75 ,,
Sand	46·61 ,,
Organic debris	0·56 ,,
Moisture	4·05 ,,

Fine Earth (20 mesh sieve)	83·070 ,
Insoluble in nitric acid	74·131 ,,
Soda (Na_2O)	0·032 ,,
Magnesia (MgO)	0·039 ,,
Lime (CaO)	0·021 ,,
Alumina (Al_2O_3)	0·198 ,,
Silica (SiO_2) soluble	0·597 ,,
Ferric oxide (Fe_2O_3)	3·850 ,,
Moisture and organic matter	4·189 ,,

Remarks : 1. The soil contains traces of potassium, phosphorus, chlorine and carbon dioxide.

2. The lick is situated on the bank of a little stream, which always contains water, about two miles distant from Salt-lick No. 107.

3. The lick is much frequented by sambhur and chital.

LI. *Common Earth*

Serial No. 110.

Locality—Begur Reserve, about 15 miles from Manantoddy, Wynaad.

Collected and sent by—D. Mc D. Currie, Esq., District Forest Officer, Wynaad.

Friable lumps of black soil, with many rootlets. Powder soft.

Minerals	38·12	per cent.
Clay	16·03	,,
Sand	36·74	,,
Organic debris	2·07	,,
Humus	0·78	,,
Moisture	5·68	,,

Fine Earth (20 mesh sieve)	58·200	per cent.
Insoluble in nitric acid	45·160	,,
Lime (CaO)	0·326	,,
Alumina (Al_2O_3)	0·269	,,
Silica (SiO_2) soluble	6·610	,,
Ferric oxide (Fe_2O_3)	0·594	,,
Moisture and organic matter	4·930	,,

Remarks : 1. The soil contains traces of sodium and phosphorus.

2. The earth was collected from a spot about 200 yards away from Salt-lick No. 109.

REVIEWS.

I.—PAGEANT OF WINGS, by Douglas Gordon. Pp. 304. London: John Murray; 1938. Price 8*s.* 6*d.*

This book consists of seventeen chapters describing the marvels of animal life and behaviour; and though dealing mainly with birds, it has also many references to the denizens of the sea and coast-line, of the field, wood and moor. It makes no claim to strict scientific treatment, and its best portions are those farthest from the systematic method of professional studies. The author abandons himself to those aspects of animal life that have been a most constant source of interest and pleasure, and have come most frequently under his observation. His standpoint is one of experience and common sense, and his watchful eye is always open to the seeming eccentricities and drolleries of animal behaviour rather than to those proper responses to environment and evolution duly catalogued by the science of the schools. Mr. Gordon tells many good stories of personal encounters, the humour of which is enhanced by gay little drawings.

The reader will find here much that he may wish to know about the aeronautic artistry of birds, the mysteries of night and dawn, vocal expression, colour scheme, comedy and tragedy at home and abroad, domestic life in the open and behind the green curtain, perils at sea and on land, the charm of the seal, the land of pigs and poetry, etc.

The author may lay claim to be a writer of singularly charming narrative.

J. F. C.

II.—TREES AND MEN, by E. Hughes-Gibb. Pp. 172. London: Alexander Moring, Ltd.; 1938. Price 8*s.* 6*d.*

Mrs. Hughes-Gibb always impresses one as knowing what she is writing about, and her books hold the attention of the specialist and of the general reader alike. This volume, which aims at describing the true relationship of men with trees, is intensely interesting and full of curious details about the characters, habitats and provenance of trees; it contains plenty of solid observed fact, and this is never allowed to slide into hypothesis.

Right from the dawn of history, records reveal that the trees have nursed us, watched over and sheltered us, fed and warmed us. We have to thank them for the production of soil and the fertilisation of the earth; for the control of climatic conditions by regulating temperature and dryness; for the check they exert on jungle life, and for their value as purifiers and oxygen manufacturers in great towns and cities. And ever as our powers and needs grew and the complexity of our life developed, the trees have been ready for us and supplied us with paper and artificial silk, the greens and blues and purples of aniline dyes, cordite and lyddite, turpentine and rosin, rubber and cork, and sugar. Science has shown the way to many profitable by-products and, impelled by their greed for money, men have wantonly destroyed the friends on whom they depend so much.

The trees that have been sacrificed wholesale by man must by man be replaced. And it is gratifying to note that at present there are everywhere in the civilised world signs that man is awakening to the great value of trees and to their real place in the economy of Nature. He no longer thinks of them merely as producers of useful or necessary commodities; he realises that they have a larger rôle. The need of Afforestation is no longer a disputed question, and already the work has begun in many countries. However good the other chapters of the book may be, those on afforestation and forest fires are the best of all and the most interesting.

J. F. C.

III.—LE PETIT PEUPLE DES RUISSEAUX. Par Marcel Piponnier. Pp. 130. Paris: *Bourrelier*; 1938. 13 francs.

The author writes of the lower animals which people small streams, a fauna which is largely cosmopolitan and, on this score, ought to arrest the attention of naturalists the world over, India not excepted.

The book is attractively got up, well printed, generously illustrated, and inexpensive. It opens with a chapter on aquatic plants, by way of an introduction to the habitat, a factor of paramount importance in the everyday life of the occupants: their likes and dislikes, their tempers and humours, their modes of getting a living, and their relation to man. Here are the surface gliders and the divers: beetles, bugs, and the larvae of drone-flies and mosquitoes; lower down, all manners of crustaceans, such as *Cyclops* and carp-lice; still further down, the larvae of caddis-, crane-, dragon-, and May-flies; and at the bottom, shrimps and molluscs in plenty. Dipping almost at random into these chapters, the reader may be sure of coming upon curious and out-of-the-way happenings, quite unlike the commonplaces of many natural history books. Especially engaging are the accounts of the mosquitoes and the shrimps. Another good chapter is that about worms and leeches.

M. Piponnier has done his work admirably, and the whole book bears the authentic stamp of the nature lover.

J. F. C.

IV.—THE ANNUAL REPORT AND BALANCE SHEET OF THE CEYLON GAME AND FAUNA PROTECTION SOCIETY FOR THE SEASON 1937-1938 has been recently issued (November 1938).

This Society was first formed over forty-four years ago 'To prevent the elimination of Game in Ceylon, by destruction of animals for trading purposes, to further the interests of legitimate sports, and to conserve one of the food supplies of the inhabitants.'

The objects of the Society were revised in 1928, the Rules being also revised, and the scope of the Society extended so as to embrace the general Fauna of the Island. In these the reference to 'one of the food supplies of the inhabitants was rightly omitted for the great reduction in the number of animals and birds which has taken place no longer permits of such supply, apart from the fact that in these modern days domestic animals and birds can furnish all the meat that is needed by the people, and there is no justification for slaughter of wild creatures for food.

A comprehensive History of the Society was published in 1931 by Mr. A. C. Tutein-Nolthenius, a most enthusiastic and hard-working member of the Society for the past twenty-two years, and reviewed in our *Journal* (vol. xxxv, No. 3 page 665). The many difficulties up to then encountered by the Society were fully set out, these including the failure to enforce the Laws, and Rules thereunder, enacted by the Ceylon Government which, if memory serves correctly, stated on one occasion that 'Our Game Laws are quite efficient but we regret we have not the power to enforce them'!

That regrettable state of affairs appears to continue, for at the present time the new Fauna and Flora Protection Ordinance (No. 2 of 1937) which was proclaimed and came into force on the 1st March 1938 has (page 3 of the Report), 'been considerably better honoured in the breach than the observance. It has already, in fact, become another dead-letter Ordinance, outside certain of the Reserved Areas that are watched by Forest Department Guards and Watchers, and the small areas watched by our own Watchers.'

Such a regrettable state of affairs is not peculiar to Ceylon. Madras goes one better! (or worse) as the South of India Wild Life Protection Society launched in 1933 with a flourish of trumpets from Ootacamund and Madras was moribund within a very few months of its inception, and has not since been heard of. It appears to be as dead as the Dodo.

The Ceylon Society however, its work carried on by a strong Executive Committee aided by a very able Honorary Secretary, does all that is possible: so there is much hope for the future.

The membership of the Society is now 280: 2 Life Members, 251 Ordinary Members, 23 Overseas and 4 Honorary Members.

The Society's Journal *Loris* continues to appear with increasing popularity; and the Wild Life Calendar for 1939 with 24 full plate photographs of Wild Life of Ceylon jungles (Rs. 2·50, post free) is a very excellent idea which might be copied by our own Society.

Reports on Reserves by the five Honorary Wardens are interesting to read.

In 1929, there were 66,936 licensed firearms in Ceylon and about 836 game licenses. The Game Licenses issued in 1937-38—1st November to 30th April—were 526. We are not informed if the 66,000 have increased or decreasd: but judging by what has been happening in India it is likely that they have very largely increased and that many of them are used for the slaughter of all kinds of small animals and birds to satisfy the meat-hunger of the people—the something-for-nothing demand.

The appointment of a whole-time Game Warden has been urged by Dr. R. L. Spittel as vitally necessary to the proper enforcement of the new Ordinance and the Rules. In this he will, as he says, no doubt have the support of every member of the Society and of all who have real knowledge of the realities of wild life preservation. It is likely, indeed, that the Ordinance will continue to be a dead-letter unless such an appointment is made.

A cash balance of Rs. 1,971 is carried over to 1938-39.

Mr. A. C. Tutein-Nolthenius has been elected President of the Society and Mr. W. W. A. Phillips, Honorary Secretary for the past ten years, continues his good work.

The Report for 1938-39 Season will be looked forward to with much interest.

R. W. B.

MISCELLANEOUS NOTES.

I.—WHY ELEPHANTS VISIT SALT-LICKS.

I obtained the answer to a phenomenon that has puzzled me for years when photographing elephants, and incidentally am able to record something to the *credit* of the salt-licks. I have often noticed that at salt-licks frequented by elephants there are enormous accumulations of droppings more or less in the same place and all looking as if they had been placed there at the same time. But as, in some cases there was so much, even what appeared to me to be far beyond the capacity of an elephant, I often wondered how they managed to do it. I know now. Here is the solution. When I went into the lick I carefully examined the edge of the lick with my glasses and saw that although the elephants or an elephant had been there about two days before, the rim of the pool was practically free from droppings. The big elephant came in about a quarter to five and after I had exhausted all my available films I left him to it. The following morning I went to the lick but the elephants had moved off. But, along the edge of the lick there was an accumulation of droppings which would have been a credit to an entire herd of elephants. No doubt the smaller one had been there too but he evidently did not go to exactly the same place as the big bull. I did not make any examination then because I expected to be there for some days and did not want to disturb the lick. But at the end of my last day there—the elephants never came in again—I made a thorough examination of the place and found that this enormous accumulation of dung—about half a bullock cart load!—had obviously been made by the big elephant; partly on account of its size and partly on account of its coarseness. The dung of the smaller one was much smoother. I had a good look round the game tracks leading into the lick and I have no hesitation in saying that the night those two elephants had been in the vicinity they must, or at any rate the big one must, have gone in and out of the lick very many times. I therefore deduce that the sulphur, which from the length of time the elephant sucks up the water must amount to a considerable quantity, acts as a pretty quick aperient and the 'walk round' is done between times to get it to work properly! Finally I suppose when he feels he wants a little more of the lick, 'that salt-lick feeling' he goes down again and has a good drink. While there his tummy works and he adds to the mound. Of course there is a good deal of speculation about these deductions of mine, but I think it is more or less a fair conclusion to arrive at. The salt-lick is their chemist's shop, and in the case of a sulphur-lick it works very quickly. I am sure this will interest you.

SUNLAWS,
BUKIT BETONG,
KUALA LIPIS, PAHANG, F.M.S.
November 12, 1938.

T. HUBBACK.

II.—THE MATING OF ELEPHANTS.

While out shooting wild elephants in 1919 on the west of Payagale, about 20 miles north-west of Pegu, Burma, I chanced to witness a unique sight, and was sorry to be without a camera at the time. It was the mating of a wild bull-elephant and cow-elephant. I was searching for a tusker that morning and came upon a herd of wild elephants which were scattered grazing. Entering stealthily in their midst followed by two Burman guides, I saw from a hill streamlet, after an hour's stalking, two wild elephants—a bull tusker and a cow—far removed from the herd just at the foot of a hillock. The bull had its trunk round the left hind leg of the cow-elephant, at the same time pressing his right tusk on her left rump, using this as a lever to inflict pain so that the cow would be obliged to submit to his wishes. No resistance was shown, apparently because the bull had a thorough hold on her.

From my place of vantage, say within 50 feet away, I saw the bull forcing the cow, held in the above manner, to walk up the rising ground for about the space of 20 or 30 yards; they turned and the bull loosening his hold, rose on the cow in the act of service. They gradually descended in this manner to the foot of the hill. On reaching level ground the bull got off, laid hold of the cow again as described above and made her repeat the ascent. This movement was carried out three or four times in succession till the service apparently came to an end.

The wild bull then released the cow which ran away to join the herd once more. The bull stood for sometime before he moved off.

The scene was so impressive and unique that I was loath to shoot the tusker, and allowed him to go his way. I don't think such a sight has been witnessed by many shikaries, and I therefore record this note.

No. 10. 3rd Street,
Pegu. J. GONZALEZ.
November 27, 1938.

III.—BEHAVIOUR OF GAUR OR INDIAN BISON (*BIBOS GAURUS*).

Major Rossel in his article on page 325 of your September 1938 issue, comments on the apparent inability of bison to recognize men moving in the open at over 50 yards; I have had many experiences of the same kind and at much shorter ranges, when trying to obtain photos. Twice recently I have stalked up to solitary bull bison in fairly open country. In one case I managed to conceal myself behind a bush while I prepared my camera for action. When all was ready I found that the bison was walking slowly straight for my bush and when he had reached a distance of about 20 yards I stepped out into the open. As he had his head down when I first stepped out from behind the bush I gave a shout in order to make him look up. This he did at once and remained staring at me for some considerable time. He did not appear unduly alarmed and eventually turned round and trotted off slowly, pausing several times to look back.

Personally I think the eyesight of the gaur is poor. When first observing a strange object, his curiosity overcomes all other inclinations. The sense of hearing is quite good, but as bison themselves generally make a lot of noise, either feeding or beating off flies, most ordinary sounds are inaudible to them.

Their ability to scent human beings at a distance is distinctly good and I have known a herd wind me at a distance of a quarter of a mile in open country. When compared with the Burma *saing* or *banteng*, the gaur seems a rather stupid animal or at any rate he exhibits a much greater indifference to danger. The *saing* has much better powers of vision and a far greater sense of smell. Twice recently I saw very definite proof of this. On the first occasion I arrived at a big salt-lick to find a herd of bison and a solitary bull *saing* with the bison. The wind was not really favourable for the animals to get my scent, but in a couple of minutes the bull *saing* had galloped off whilst the bison appeared quite unconcerned. On another occasion I came on a herd of about 50 bison resting in open country with a pair of bull *saing* lying down with bison. On this occasion a fairly strong wind was blowing from the herd towards me and I was able to approach to within about 30 yards of the nearest bison. I then sat down chiefly with the object of seeing whether any of the animals would become suspicious. Within a few minutes the two saing began to show uneasiness and after walking towards me for a short distance, they charged off. The bison on the other hand, after the first alarm caused by the saing running away, did not appear worried. Another characteristic of bison is the manner in which they will fraternise with elephant.

I have often seen wild elephant and bison feeding peacefully together; and last rains I obtained rather striking proof of this characteristic of bison. I was touring in the Pidaung Sanctuary (where incidentally the animals are just as wild as elsewhere) and spent a few days riding round on a tame elephant. One morning I came on a huge herd of bison, numbering more than 100 animals resting in open scrub forest and I was able to approach within a few feet of the bison which showed not the slightest suspicion. It was indeed a rather remarkable sensation when I 'looked an old bull in the eye' at a range of 15 feet. I should mention however that it was necessary to keep the wind in the right direction and when eventually I began to wander into the herd the bison knew that something was wrong. The effect of more than a 100 huge black bodies rising simultaneously from every bush in the locality was indeed striking. All attempts to approach saing on the elephant proved futile and I could never approach nearer than 50 yards. Hog deer were also thoroughly frightened by the elephant, but I passed several sambhur at very close range without causing them any alarm.

MAYMYO, BURMA. F. J. MUSTILL.
November 5, 1938.

IV.—DERIVATION OF THE NAME SELADANG

In the very interesting article by Mr. Hubback on the Malayan Gaur or Seladang a derivation of the name seladang is suggested on page 10. It seems possible that the name was imported into Malaya with the animal, as it is suggested that the animal came in from the North. The Manipuri word for the mithun (*Bibos frontalis*) is *sandang* and the Kuki word for the same animal is *sel.* Further research might revel that the word is similar in other languages.

IMPHAL,
MANIPUR STATE, C. GIMSON.
ASSAM.
December 27, 1938.

V.—SORE NECK IN SAMBAR.

The Theory of 'Atavistic Degeneracy'.

In my article on the Malayan or Burmese Sambar (*Rusa unicolor equinus*) which was published in the *Journal of the Bombay Natural History Society*, vol. xxxix, No. 2, dated 15th April 1937, I touched at considerable length on the subject of the 'Sore Neck in Sambar'. Subsequently Mr. S. R. Daver of Jagdalpur, Bastar State, India in an interesting article entitled 'Cause of Sore Neck in Sambar' (*Journal,* vol. xl., pp. 118 to 122) gave his views on the subject. He stated that he had the good luck to read a passage in a small book *The Story of Animal Life* by Mr. B. Lindsay which explains the cause of 'Sore Neck' in Sambar in such a manner that it *leaves no room for any doubt.* Mr. Daver states that the fact of the matter is that the Sambar, although sometimes described as the 'Monarch of the Dale', does not carry any blue blood in his veins. He has a much humbler origin than people think. The 'Sore Neck', Mr. Daver says, is nothing but a badge of an inferiority complex which sambar and other higher forms of animals carry round their necks to remind them for all time that they were once marine animals. When the Himalayas were under water these animals including the ancestors of the Sambar perhaps, were swimming in the shallow sea. Mr. Daver says that he has seen several sambar at close quarters during the course of 20 years of his roaming in the jungle but has never seen a single specimen of a sambar with a 'sore neck'. In biological language 'sore neck' according to Mr. Daver, is an instance of 'atavistic degeneracy'. Mr. Daver quotes Mr. Lindsay:

> 'What we see as a bare patch and a sore on the necks of the animals used to be a place where gills were attached when these animals were leading a marine life. The disease is called "cervical fistula".'

Mr. Daver goes on to quote another extract from Mr. B. Lindsay's book as follows:

> 'Nor do we need to go into the nursery to find links with our inferiors. Much, indeed far too much, has been written of late years about "atavistic degeneracy", that is to say, degeneracy which imitates the characteristics of our forefathers. Many things which are classed as diseases, whether of the body, mind, or moral nature may be explained in this way. Take the gills which as we have stated exist in all the vertebrates but not in the adult of the highest groups. In a sickly individual even amongst the highest vertebrates, traces of this are sometimes seen existing in the adult as a gap or open space in the neck called by the medical man "cervical fistula": this is an instance of degeneracy in the body. Take, for another instance, the kleptomaniac who snatches up everything he takes—a degeneracy of the mind, a relic of savage nature out of place in civilized man. Yet the gill space is an ancestral feature which has its right time to appear though it is out of place in the adult: and the "want to snatch" stage, as we have already seen is quite natural in the young child.'

To understand clearly the development, position, and modification of gills in the modern animal Mr. Daver quotes another passage from Mr. B. Lindsay's book, as follows:

> 'The classes of the vertebrata are fishes, amphibia, reptiles, birds, and mammals. We used to learn that these fishes had gills, and amphibia gills for a time; but to be strictly accurate, we must say that fishes have gills and all the rest of the vertebrates have gills for a time. There is no exception to this rule not even among the highest vertebrates. But in these vertebrates which stand higher in the scale of life than amphibia, viz. reptiles, birds, and mammals, these gills are never brought into use. They only exist in the early embryo and afterwards disappear, giving rise by their modification to other structures. Strange to say one of these structures is the ear. This takes its origin from one of the gill clefts or spaces. The Eustachian tube which communicates between ear and nose is part of this cleft; and the little bones which are inside in the ear represent the bones of the "gill cleft". For in fishes, bones support each gill and are conected together to form a complex arrangement. In the higher vertebrates, which possess gills only in the embryo, this gill skeleton is much modified and persists as a bone, its hyoid bone supporting the tongue. The gills of vertebrates arranged in successive pairs along the throat, are "performing gills, that is to say they consist essentially of holes or spaces which pass right through the wall of the throat."

Since reading Mr. Daver's theories in the *Journal* regarding the cause of 'sore neck in sambar' I have tried but failed to obtain a copy of Mr. Lindsay's book. However, I also had the luck to come upon an article entitled 'The Concept of Atavism', which it appears to me does not quite uphold Mr. B. Lindsay's theory or Mr. Daver's explanation that the sore in question is a gill. The salient portions of the article in question are herewith reproduced.

> 'During the days when biologists were sedulously engaged in supplying the finishing touches to the house that Darwin built, it was the usual practice

to regard every possible arrest in development or unusual character of an organism as the persistence or recurrence of an erstwhile normal feature of the particular organisms, ancestor, or ancestors. Such a reversion to the presumed ancestral condition was termed an "atavism" from the Latin "atavus", an ancestor. This concept and the term expressing it, abounds in the writings of nineteenth century biologists. Haeckel's "Biogenetic Law" really represents a generalized synoptic version of this concept applied to a particular case, and calculated to resume a certain supposed routine of phenomena under a particular law. Today few biologists believe that in its ontogenetic development any animal actually repeats the developmental stages of its phylogenetic history. In development the organism apparently passes only through those stages of development which are akin to similar stages passed through in the ontogenetic development of its ancestors; and this is essentially what Van Baer said in his "Hypothesis of Recapitulation", which is not to be confused with the so-called Biogenetic Law. In development the organism does not repeat the adult stages of its ancestors, but only those stages of development through which its ancestors as a whole have more or less in common passed. This, as Van Baer originally pointed out, is why the early stages of related animals resemble one another more closely than do the differentiated adults. Modern recognition of these facts has brought the Biogenetic Law into disrepute. The conception of Atavism however, persists. Reference to many modern texts on embryology, general biology, and the writings of a fair number of morphologists, will supply examples of the uncritical usage of this term. One recent work by a notable worker has a section entitled "Reappearance of Lost Ancestral Structures in Man" and as the example of such structures we are given the gill pouches . . . (of) the early embryo . . . (which) may . . . persist and form an open fistula on the side of the neck". Surely it is clear that such a fistula is due to the mal-development or arrest in development of an embryonic character of the individual and not to the reappearance of a character which the species and class has lost but which may have been present in some remote phyletic ancestor. In this connection it is worth drawing attention to the fact that the conventionally accepted homology between the gill pouches or arches of fishes and the branchial arches of mammals is open to serious question.

The occasional occurrence of a tail in man or of an azygos lobe of the right lung, microcephaly, large canine teeth, the fourth molar, the divided molar bone, the "third trochanter" of the femur, the entepicondylar foramen of the humerus, super numerary mammae, and many other characters have been and still are cited as examples of atavism. Yet in every case it can be conclusively shown that such characters are not upon *any view* to be regarded as reversions to an ancestral condition. Changes in development and in development rates resulting in persistence, suppression, reduction, hypertrophy, duplication, multiplication of structures and normal variability are processes quite adequate to account for the so called "atavisms" which are commonly cited. In short it is more than doubtful whether the concept of atavism has any counterpart in reality; and I think it will be agreed that unless the concept can be applied to some demonstrable type of phenomenon it were better that the term were altogether dropped from the vocabulary of the biologist.'

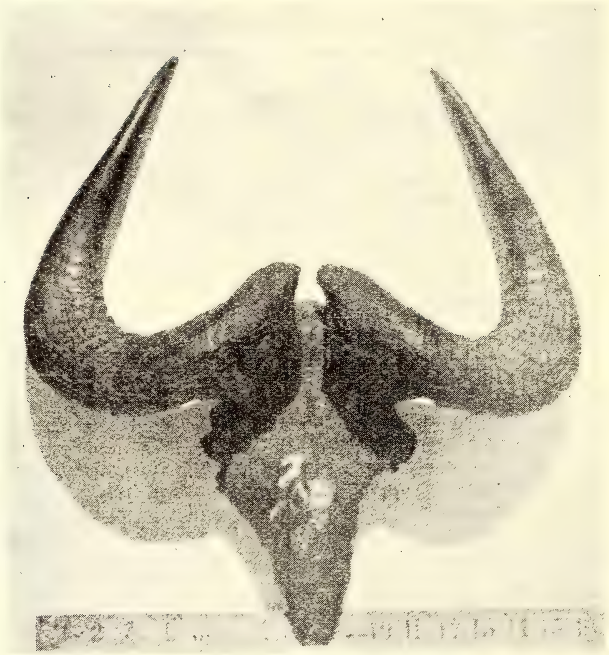
It seems to me therefore that we can hardly accept as correct Mr. B. Lindsay's theories which Mr. Daver has supported in his article about the sambar sore being a gill and its appearance being due to atavistic degeneracy. There is nothing degenerate about the Malayan Sambar as we hunters know full well. It really is not a bare patch at all but an area oozing out. . . . something, a scent, a perfume gland. Black buck, elephants, and camels have them; whilst serow have them between the toes. It seems strange nevertheless that although there must be quite a large number of experienced scientists and naturalists in the country apart from experienced sportsmen none of them have as yet succeeded in discovering why that circular sore on the sambar's neck is there, always in the same spot. Can it be a secretory gland? No doubt we will get to the bottom of this matter in the near future.

KALAW,
SHAN STATES,
BURMA.
October 1938.

W. S. THOM.

VI—THE RECORD THAKIN HEAD.

(*With a photo*).



I enclose herewith a photo of a thakin head which has recently come into my possession. The head was brought down by a Mishmi tribesman several years ago and came into my possession through the courtesy of Mr. F. P. O'Connor of Itakhooli Tea Estate.

The frontal part of the horns are extremely gnarled and ridged and this point combined with close proximity of the two tips indicates the great age of the beast.

The measurements—very carefully taken and checked by a friend—are as undernoted :—

Length.	*Girth.*	*Tip to tip.*	*Widest spread.*
25¼ Rt. 25 Lt.	15 15	8	17

Unless Rowland Ward's Records contain measurements which can beat it this head would appear to be the record.

There is one head given in Burke's *Indian Field Shikar Book* which has horn lengths of 25 and 24¾ but the spread is no more than 13¼.

The measurements, when compared with those given in this book of records, are remarkable for the 'tip to tip' measurement, and the 'widest spread'.

HOOGRIJAN TEA ESTATE,
UPPER ASSAM.
November 18, 1938.

F. WOOLEY SMITH, D.F.C.

[The largest head of a Mishmi Thakin recorded in Rowland Ward (9th Edition) is one belonging to the late J. F. Needham. The owner's measurements are as follows:—

Length on Front curve	*Circumference*	*Tip to Tip*
25″	13″	11½″

—Eds.]

VII.—A TREE MOUSE (*VANDELURIA OLERACEA*) IN THE NEST OF A SPIDER.

Dr. Gravely, in his notes on 'Indian Insects, Myriapods and Arachnids' (*Rec. Ind. Mus.*, xi, 1935, p. 535), while discussing at length the habits of the spider *Stegodyphus* (Fam. ERESIDAE), observes as follows:

'Associations of other animals with African species of *Stegodyphus* have been recorded by Marshall and Pocock. Marshall describes a doormouse which lives in *Stegodyphus* webs and ultimately drives away the spiders, and both authors refer to a *Microlepidoptera* which lives with the spiders in their nests.'

To add to this his own experience in India, Gravely cites the case of the Moth (*Brachmia xerophaga*), living with *Stegodyphus sarasinorum*: also that of a *Uloboid* spider making use of the webs of *Stegodyphus* and concludes that 'other associations, probably of a more casual nature, may also occur.' To illustrate this remark, he narrates how, once in Orissa 'when pulling STEGODYPHUS nests to pieces in order to obtain lepidopterous larvae,' he found 'in addition, the following animals alive within them:

one Cribellate spider (? DICTYNIDAE),
one Centipede (? GEOPHILIDAE),
one large LEPISMATID and
two minute Beetles (ANTHICIDAE and CLAVICORNIA).'

In support of the foregoing, may I venture to place before your readers further evidence which I have recently come across. Whether the association is casual or of a permanent nature cannot be said without further evidence but the case is quite unique as no similar incident has been, to my knowledge, ever recorded from India.

On 11-8-1938, I went for a whole day cross-country tramp with my friend, Mr. R. G. Kharadi, B.SC. We intended to collect insects for the museum of the Gujarat Natural History Society.

After going for about ten miles, we entered a grove of mango trees, where I saw a spider's nest at the end of a branch. The height of the nest was about 8 feet and I had to take a couple of jumps before I was able to take hold of it. While trying to locate the entrance to the nest which appeared to be blocked by some dark object in the interior, I was startled to find a pointed nose and beady eyes staring at me! Hastily I let go of the branch and up it went to its original position. We now determined to collect both the nest and its occupant (which we realised was a mouse) and again after some fancy jumping, I succeeded in breaking off the portion which supported the nest. The mouse had disappeared inside the nest; to prevent its escape, I placed the nest in a cloth bag and tied its mouth. On the way home we came across several spider nests in cactus hedges, which we collected with their occupants but nowhere did we find any other animal occupying them nor did we again see another tree with a spider's nest in it.

On inspection in the laboratory the nest was found to contain not only several spiders and a mouse, but also a litter of six young mice! Mr. Kharadi was able to identify the mouse as *Vandeluria oleracea*, the Long-tailed Tree Mouse, which was later verified by Mr. Prater. The spiders were dark brown or blackish in colour with markings on the top of the abdomen. I think they are *Stegodyphus sarasinorum*.

AHMEDABAD,
NORTH GUJARAT,
October 9, 1938.

H. G. ACHARYA,
F.Z.S.

[One of the spiders taken in the nest forwarded to the Society for identification by Mr. Acharya has been identified by Dr. Gravely as an Epeirid (near *E. nauticus*), but not actually that species. *E. nauticus* is nocturnal in its habits, resting by day in a small silk-lined retreat and going to the centre of its orb-web for the night. The retreat of this particular species is ordinarily not large enough to hold anything bigger than the owner and could certainly not contain a tree mouse and its family. The actual nest which was subsequently forwarded to us by Mr. Acharya proved to be that of the Common Social Spider, *Stegodyphus sarasinorum*. These spiders live in colonies and their nests take the form of a dense untidy mass of cobwebs, spun amongst leaves and branches, and usually contain the dry remains of various insects devoured by the owners of the nest. As indicated in the note, the nests of these spiders provide a lodging for a variety of creatures which live in association with them. In the instance under comment, the Epeirid Spider, discovered in the nest was, like the tree mouse, an intruder. The tree mouse not finding the nest quite to his liking proceeded to refurnish it with pieces of dry grass, the remains of which were found in the nest. The Long-tailed Tree Mouse lives in trees and shrubs and usually builds a nest of grass or grass and leaves in the branches. It occasionally places its nest in the thatch of houses or in beams; but, like the African Doormouse, it may occasionally take up its quarters and rear its family in the nests of other creatures. McCann found one of these mice occupying the deserted mud nest of a swallow.—EDS.]

VIII.—NUMBER OF YOUNG OF LONG-TAILED TREE-MOUSE *VANDELURIA OLERACEA*.

Blanford (*F.B.I. Mammalia,* p. 403) says that he found '3 young on one occasion and 4 on another'.

I recently came across a nest of social spiders (*vide*—Misc. note no. VII in this Issue) inhabited by a ♀ Long-tailed Tree-Mouse (*Vandeluria oleracea*) with 6 young which had not opened their eyes yet. The measurements of the young were as follows:

Head, body 1⅜ in., tail 1 in. Adult female: head, body 3 in., tail 4½ in. (Blanford's measurements for a full-grown adult are: head, body 2.2 in. to 3 in., tail 3.5 to 4.5 in.)

AHMEDABAD,
NORTH GUJRAT.
October 9, 1938.

H. G. ACHARYA,
F.Z.S.

IX.—LEOPARDS FROM VICINITY OF NAGA HILLS.

These are the particulars of some adult leopards shot in this vicinity.

	Length.	*Weight*		*Length.*	*Weight.*
Males	6′ – 11″	123 lbs.			
	7′ – 3″	130 ,,			
	7′ – 1″	135 ,,	Female	6′ – 1″	82 lbs.
	7′ – ½″	127 ,,		6′ – 3″	79 (Black)
	6′ – 7″	89 ,,		6′ – 2″	72
	7′	–		5′ – 10″	–
	7′	–			
	6′ – 8″	100 ,,			
	6′ – 6″	–			

It would appear that unlike the tigers of this district the Leopards compare in length and weight with those recorded from other parts of India.

TOWKOK TEA ESTATE,
SONARI P.O.

G. H. L. MARSHALL.

X.—MEASUREMENTS OF TIGERS SHOT IN THE NAGA HILLS

A Correction

In the proceedings and account Section of Vol. XL. No. 2 I notice you state Mr. Marshall publishes records of tigers shot 'by him' in the Naga hills, Assam. I would like to point out that this is incorrect. The total of 59 animals comprises the bag of many fellow sportsmen to whom I am greatly indebted as well as my own. I am responsible for the game register of this district and have personally measured many of these tigers and can vouch for the accuracy of the figures.

TOWKOK TEA ESTATE, G. H. L. MARSHALL.
SONARI P.O.
December 15, 1938.

XI—MIGRATION AND METHODS OF BIRD SNARING IN NORTH EAST ARABIA.

(*Five text figures*).

From a bird life point of view, Kuwait, and the promontory on which the town lies, would appear to be one of the most interesting spots in the Middle East for the study of migratory birds. I do not profess to be able to explain why this is so, but to my mind Kuwait can be likened to the Northern end of a long narrow corridor or tunnel, through which migratory birds, moving up from South East Arabia and India, along the Western shore of the Persian Gulf, and conversely moving south again (though to a lesser degree), have to pass. Thousands of migratory birds seem to pass over Kuwait town and the strip of coast about twenty miles wide, which stretches south along the Arabian shore.

The phenomenon may have to do with the fact that birds flighting to and from Northern climes and the Tropics, and who happen to choose the Western shore of the Persian Gulf for their route, are inclined to hug the sea coast, as being cooler and having more watering places where they can assuage thirst than in the interior.

Certain it is that every variety of migratory bird is so common during the Spring, and to a lesser extent during the Autumn migration, that almost the entire youth population of Kuwait town, and the tribes lying on the coast to the south of it, go in for catching and trapping these birds as a regular pastime.

The birds so caught are sold in the bazaars as playthings to amuse other children, or are eaten, or again are sold to those owning Falcons with the object of providing a change of diet for these birds in the non-hunting season. The market price is about nine pence for just over four pounds of small dead birds.

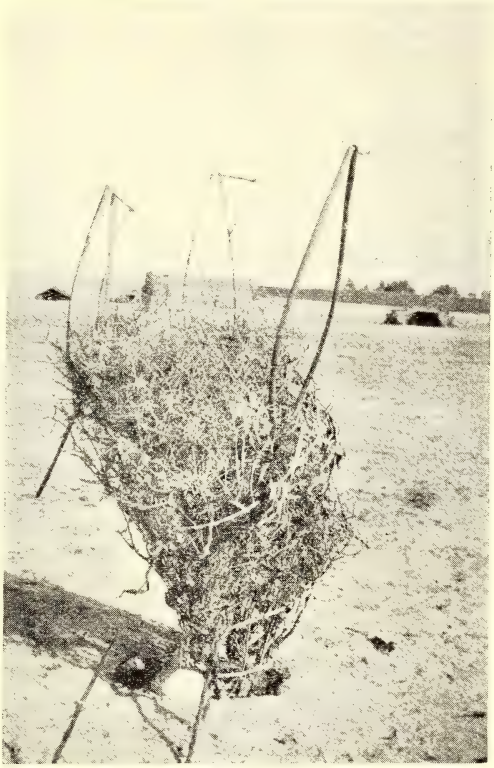


Fig. 1.—Three *Sulāba* traps in an artificial bush made of cut branches of thorn.

On almost every house roof in Kuwait and the villages to the south of it, as well as on the ground in the vicinity of Badawin encampments, one can see small artificial trees, made of clumps of bushes tied together and placed in prominent positions to attract birds in flight. Each of these bushes contains several traps of the type called *Sulāba,* and it is astonishing how many birds are caught and brought down from the house tops by the youth of the city.

Though it is all very heartless and cruel from a Westerner's point of view, I must admit that the sport affords great happiness and joy to thousands of youths, and young boys, who have little else in the world to brighten their drab lives.

The skill with which these young Esaus set their traps and entice birds to come and be caught, has only to be seen to be believed. It is little short of marvellous.

There are three main types of traps used for snaring small birds. They are known as:—

(1) 'Fakh'
(2) 'Sulāba'
(3) 'Sālia'

(1) The 'Fakh' is mostly used for catching the Lesser Kestrel Hawk which appear some years literally in tens of thousands over the town during the end of March and April. These birds are caught with a decoy. A Kestrel is obtained, and tied by both legs to a heavy stone with a strong piece of cord about 2 ft. long, in a place near some trees where the birds are known to roost. All round this bird are placed 'Fakhs', carefully covered with light sand and pegged to the ground, with only a wriggling grub visible. The Hawks seeing the one on the ground circle round

and round above it, and eventually settle round about and are caught as they peck at the grub on the trap. The boys, who lie hidden behind a wall or in some shallow pit, then rush out and capture the flapping bird. The traps are carefully adjusted so that the bird's legs are never broken, but the trap is just too heavy to enable them to fly away with it, although they very often drag the peg out of the ground.

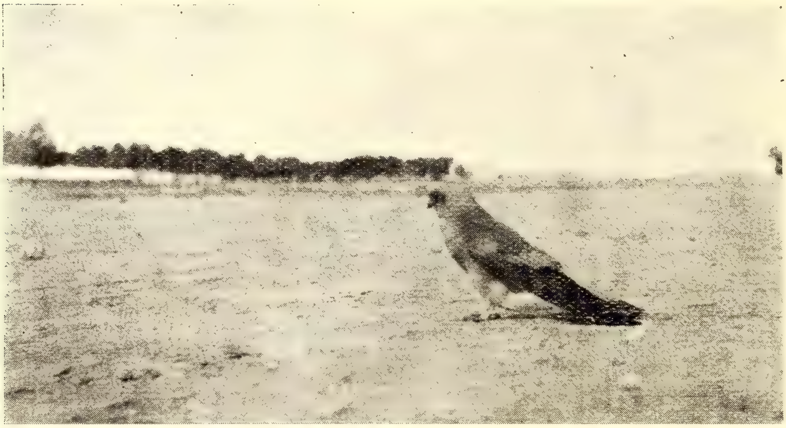
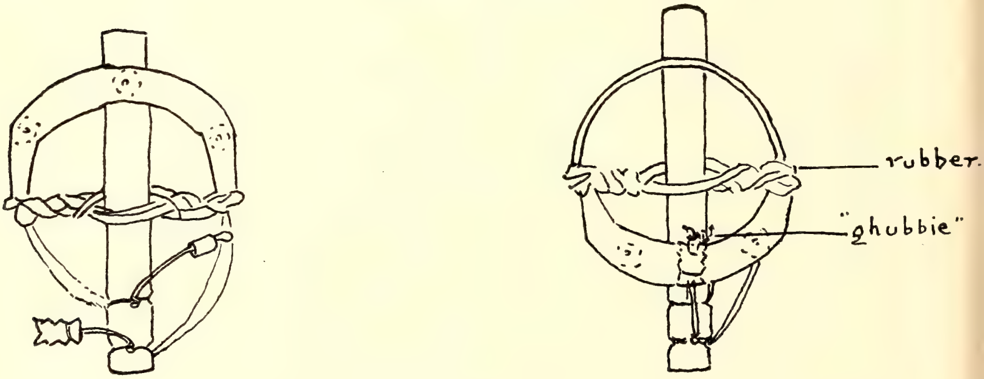


Fig. 2.—A 'decoy' Kestrel, tied by the leg and surrounded by carefully covered traps of the *Fakh* type.



Trap sprung

Trap set.

Fig. 3.—*Fakh.*

These lesser Kestrels are a great joy to the boys of Kuwait who walk about with them on their wrists imitating the Sheikh's falconers.

The Oil Company's rig, which has been put up this year some 35 miles South of Kuwait town has attracted these birds to roost on it in thousands.

Shrikes and many other small birds are caught in this trap, when it is placed near a small tree where birds come to settle. The same grub, known locally as a 'ghubbie' is used, but the trap is not pegged down.

(2) The 'Sulaba' is usually placed sticking out above the artificial bushes on the house tops of Kuwait. As many as 6 can be put into one bush. In the small gardens outside the town these traps may be seen placed against the low mud walls, or perhaps in a bush of flowers or other prominent place. They are not baited, but attract merely as a perch in a land where trees and bushes are scarce. The bird alights on the peg, along which the fine string is carefully arranged, and its feet are caught in the string as the peg falls, and the two sticks spring open.

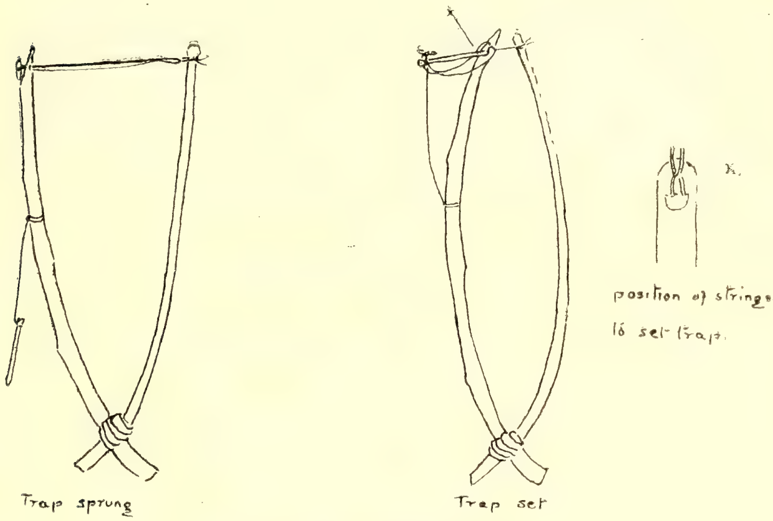


Fig. 4.—Sulāba.

The bird so caught, if it be a Shrike, has one of its wing feathers removed and passed through its nostril and round its beak twice; this prevents it from opening its mouth. It also has one of its wings twisted, which prevents it flying away. Other varieties of birds have, when caught, one wing only twisted, and then are put into small palm frond baskets and sold in the streets or bazaar.

(3) The 'Salia', or net trap, is the third kind, and is used on trees in the 'Hautas' or gardens of Kuwait. It is composed of a fine fishing net fastened to a curved bamboo frame. This is thrown over a small tree such as a 'Sidr' or Tamarix, and slopes

down to the ground at the back where heavy stones are placed on it. The small birds go to roost in the tree, and in the early

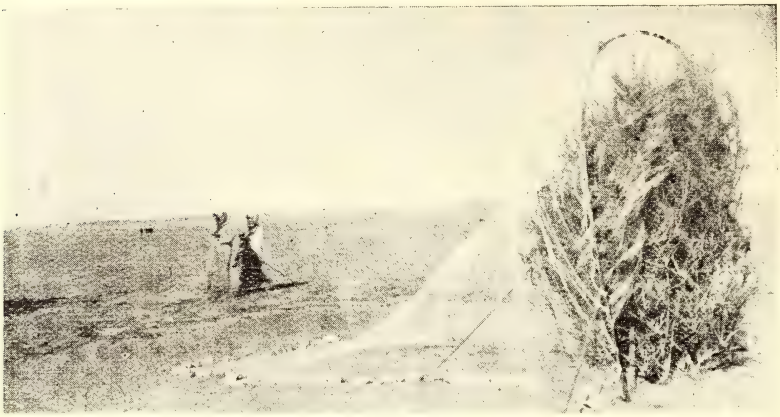


Fig. 5.—The *Sālia* trap.

morning are driven down into the net on the ground and picked out.

Kuwait,
 Persian Gulf.
 September 20, 1938.

(MRS.) H. R. P. DICKSON.

XII.—BIRDS OBSERVED IN AND NEAR TAMBARAM, SOUTH INDIA.

(*Supplementary observations made between April and October 1938 issued as an addendum to the paper published in No. 3, p. 467 of this Volume*).

7. **The Red-vented Bulbul**: *Molpastes cafer cafer* (Linn.).

August 11th 1938—nest and 3 eggs in a bauhinia tree, about 7 ft. above the ground. August 14th—eggs stolen.

8. **The Red-whiskered Bulbul**: *Otocompsa jocosa emeria* (Linn.).

July 24th 1938 and several following days—a small and newly fledged bulbul was about the garden; its red 'whiskers' seemed absent, and the red of the vent was a pale yellowish scarlet. A parent bird was observed feeding this young one.

9. **The White-browed Bulbul**: *Pycnonotus luteolus luteolus* (Lesson).

August 15th 1938—nest in gmelina bush in garden; two very newly hatched chicks. August 23rd—one of these chicks observed apparently dead in the nest at 12-30 p.m.; by 5-30 p.m. it had been removed from the nest. August 28th—the other chick almost fully fledged. August 29th—the nest empty.

11. **The Black Redstart:** *Phoenicurus ochrurus* (Gmelin).

A hen redstart in the garden on October 23rd 1938.

16. **The Paradise Flycatcher**: *Tchitrea paradisi* (L.).

October 10th 1938—a male in full white plumage in the garden. A bird in chestnut plumage, with short tail, was about the garden for about ten days from October 1st onwards. Neither bird has been seen since October 10th. Two birds in chestnut plumage, with short tails, observed catching insects from a pond in Vandalur Forest on October 3rd 1938.

19. **The Grey backed Shrike**: *Lanius schach caniceps* (Blyth).

August 7th 1938—nest in a terminalia tree in the garden, about 15 ft. from the ground, in a very exposed position. Nest very untidy, with a long bit of rag hanging from the side. Four eggs, bluish-speckled. The parent bird was seen on the nest every day for over a week. August 19th—the nest empty.

24. **The Black Drongo**: *Dicrurus macrocercus peninsularis* (Ticehurst).

July 24th 1938 and several following days—two very young drongos, with very short tails and red mouths, in the garden with adult birds. Parent birds seen feeding the young.

30. **The Brahminy Mynah**: *Temenuchus p. pagodarum* (Gmel.).

June 26th 1938—two birds seen in the garden. August 5th 1938—a small flock first seen in the neighbourhood. This is earlier than we have ever seen a flock appear before.

33. **The White-throated Munia**: *Uroloncha malabarica* (Linn.)

July 19th 1938 and several following days—several munias observed in the college jungle.

43. **The Pitta**: *Pitta brachyura* (Linn.).

October 8th 1938—the pitta heard for the first time this season in the jungle about a mile north of the college.
October 18th 1938—pittas established in the garden again.

45. **The Coppersmith**: *Xantholaema haemacephala.*

July 1938 to October 1938—coppersmiths now very common in the gardens of the college estate.

56. **The Hoopoe**: *Upupa epops* (Linn.).

July and October 1938—two hoopoes observed for several days at a time in the garden.

58. **The Common Indian Swift**: *Micropus affinis* (Gray).

Two of these swifts spent the afternoon of August 19th 1938 flying through and round our house. They have not been seen since then.

67. **The Pale Harrier**: *Circus macrourus* (S. G. Gmelin).

A female, presumably of this species, first seen this season over the college jungle, on October 6th 1938.

72. **The Spotted Dove**: *Streptopelia chinensis suratensis* (Gmel.).

August 28th 1938—a nest, with brooding bird, in a duranta bush, about 12 ft. above the ground, immediately outside a window of our house. Eggs not seen. The bird was still sitting when we went away from home on September 3rd, but the nest was empty and deserted when we returned on September 19th.

In addition to these further observations on birds already in our original list, the following have been noticed within the last few months:—

The Orange-headed Ground-thrush: *Geocichla citrina citrina* (Lath.).

October 24th 1938—an orange-headed ground-thrush in the garden for about half an hour this evening. It settled in a bauhinia tree, watching us and waiting for our departure, and therefore gave us an excellent opportunity to observe it with the field-glasses at quite short range. There was no doubt about its identity.

The Indian Koel: *Eudynamis scolopaceus scolopaceus* Linn.

Koels were heard for the first time since December 1932 in this neighbourhood on August 19th 1938, in Vandalur Forest, when the characteristic call was quite unmistakable, and was heard at frequent intervals for about an hour. Koels are very common in the gardens of Madras City, and it is surprising that they are so rarely heard in and round Tambaram.

The Indian Shikra: *Astur badius* Gmel.

October 9th 1938—a shikra bathing in one of our bird baths just outside my window, and then sitting for some time in the tree above the bath, affording excellent opportunity for close observation.

The Asiatic Sparrow-hawk: *Accipiter nisus nisosimilis* (Tickell).

October 21st 1938—a sparrow-hawk, probably a female, being distinctly brownish above, bathing in one of our small bird baths for several minutes. Birds of this type have been frequently seen here before, but have never given the same facilities for close observation and identification.

MADRAS CHRISTIAN COLLEGE, A. M. BARNES.
TAMBARAM,
CHINGLEPUT DISTRICT.
October 23, 1938.

XIII.—THE DISTRIBUTION AND NIDIFICATION OF THE INDIAN (PUNJAB) RAVEN (*CORVUS CORAX LAURENCEI* HUME) IN SIND.

The distribution of the Punjab Raven in Sind, as Ticehurst records, is rather curious.

Parts of the Province, particularly Upper and Middle Sind possess physical features and a climate similar to the southern districts of the Punjab, where this Raven is common and a permanent resident, yet its range and distribution in Sind, even in districts which are like the Punjab, are peculiar and of great ornithological interest.

So far as I am aware it is a permanent resident only in the Khirthar Range and in the Thar Parkar district, where also, it is *not* met with, except as a straggler, outside the southern and eastern talukas of the Thar desert, which is bordered by the Rann of Cutch on the South and Rajputana on the East.

I am reliably informed that this Raven is resident in the west of Jodhpur and Jaisalmir States and birds met with in the eastern *rejistan* tracts of Khairpur State and Sukkur district probably enter Sind from Jaisalmir State which borders these localities.

Ghotaru, where Blanford found it late in the breeding season is only about 25 miles from the Sind border.

Elsewhere in Sind this bird is purely a winter visitant, though quite a few remain to breed in suitable localities.

In Upper Sind, though a regular winter migrant, it is, strange to say, very localised. It is as abundant in Jacobabad now, as it was in Hume's time, 66 years ago.

At Shikarpur it is common, yet at Sukkur only about 20 miles south-east, it is rarely seen. I saw only two birds during five winters. At Ghari Yasin 10 miles south-west of Shikarpur, it is again common and extends further south, another 10 miles to Gaheja. It is again met with in Khairpur State and the northern talukas of Nawabshah district extending as far south as Darbelo and Kot Laloo, about 60 and 75 miles respectively, south of Sukkur.

To Lower Sind it is but a rare winter straggler. In 1872 Hume found it at Hyderabad and Ticehurst met with it below the Baran gorge near Soorjana, in Karachi district.

In Thar Parkar where Blanford found it 'everywhere', this Raven is known to the Tharis as Rodh Kang. As already mentioned it is resident in the desert tracts bordering the Rann of Cutch and

Rajputana and breeds on lone Kandi or Babur trees in the vicinity of desert towns, villages and hamlets.

A clutch of 4 eggs which incidentally reached me in an omelette, was sent to me from Ranahu in Khipro taluka, and 2 nestlings, there were 5 in the nest, from Diplo. Thari goatherds also told me that they had come across nests near Gadro, Chachro, Sami Vari and Mithi.

I failed to find any birds at Mirpurkhas, Jamesabad, Samaro, Digri, Chhor or Umarkot during January and February 1936 and *Tharis* told me that these places were only occasionally visited by these Ravens. At Char about 8 miles south of Samaro I came across a few birds, but failed to find any nests. *Tharis* at Char told me that it was common around desert villages and hamlets further north, east and south.

In Middle Sind I came across it in Khairpur State and Nawabshah district during the winter of 1935 and found them around town and village refuse heaps or near cultivation, at Gambat, Kot Laloo, Mehrabpur, Kandiaro and Darbelo. At Kandiaro a pair were viciously attacked by a horde of House Crows and literally driven out and away from the Canal Bungalow Compound. As I left Nawabshah district in December 1935 I am unable to say if any birds breed there.

In Upper Sind, where this Raven is a regular cold weather visitant, it is common in some places and yet conspicuous by its absense in others. In January 1930 I met with it in Sukkur district at Gaheja, Ghari Yasin, Jagon, Kot Sultan and Shikarpur, where it was very common and able to hold its own with the House Crows which swarmed there. It was partial to town and village refuse dumps, but was also met with in sprouting cultivation, particularly if freshly watered, and ploughed fields lying fallow. On the 19th January 1930 I found a nest ready for eggs in a lone Kandi tree in open forest near some cultivation between Jagon and Kot Sultan. A few days later I took a nest with 5 eggs between Kot Sultan and Zarkhel. The nest was in a stunted Kandi tree in thin forest. Here again the tree chosen was well away from any others.

During my stay in Sukkur district from 1930 to 1934, though I came across this Raven yearly on both sides of the river I found it very localised. On the left bank of the Indus it was fairly common in parts of Ubauro taluka and I found it at Khambra, Reti and Kobar. I was fortunate enough to find almost yearly, a nest or two, with eggs or young, near Janwar Belo, between Kobar and Daharki. In each case the nest was placed on a long Kandi or Babur tree in thin forest interspersed with patchy cultivation. I never found more than 5 young or eggs in a nest.

In Sukkur itself, on the right bank of the river, I met with this Raven but twice, seeing a single bird on the 14th August 1931 and another, probably the same bird, as the locality was the same, on the 25th of the month.

I did not come across it on the left bank of the Indus south of a line roughly linking Khambra and Daharki.

In the Khirthar Range, Day met with it in January. In

February 1933 I was brought a highly decomposed bird and four cracked, frothing eggs, taken from a rock ledge, near Khenji Nai, in the Northern Khirthar. The Rind Baluch who brought the evil smelling mess told me that quite a few birds bred annually, mostly on inaccessible rock ledges, in the Khenji and Sita Nai gorges.

Ticehurst saw eggs taken 'from near Jacobabad', and Culbertson also had eggs sent him from this locality. I was in Jacobabad in 1934, but unfortunately left the district in late November, too early for nests. Nevertheless I found several *old* nests on rock ledges in the hills near the Uch oasis, in Bugti territory, about 8 miles from the Sind Border and about 24 from Jacobabad. Mrs. C. J. Rae told me that she had seen many Ravens and had also noticed some nests on the cliffs there, in December or January the year previous.

At Jacobabad itself the birds were common, and were also met with along the Desert and Begari canals and at Mauladad 7 miles south of Jacobabad. Birds were first seen at Jacobabad in any numbers on the 11th October and by the 25th of November they were abundant. At one of the Regulators on the Begari Canal I once saw quite a dozen Ravens, three Small Cormorants and a House Crow or two gorging on dead and dying fish left behind in shallow pools formed by the receding waters of the canal, and Ticehurst records that Hume was informed that great numbers die because of the heat and the diet of putrid fish.

In Upper Sind this Raven is known by the name of *Takru Kang, takar* meaning 'hill'; while on the Bahawalpur State Border (Punjab), the *Seraikis* know it by its Punjabi name, *Dodar Kang*.

A shikari zamindar of Daharki told me that he often came across this Raven when shooting *chink* between Reti and Khenju in Ubauro taluka, and once found a nest on an isolated Kandi tree in the desert near Khenju, about 15 miles south-east of Janwar Below, where I have taken nests myself.

In late August and early September 1930 I came across quite a few birds in the sand *bhits* of Rohri taluka, near Mamro and Sauhara, in the desert tracts of Sukkur district, drained then, during the abkalani season, by the Eastern Nara and the Karo Naro. These birds, though, were probably early arrivals from Jaisalmir State, due to the abnormal conditions that year, a year of floods and wide spread inundation, as the same year I saw a pair at Shikarpur as early as the 30th July.

The majority of birds visiting Upper Sind arrive early in October and begin to leave early in March. I have come across birds however as early as the 30th July and as late as the 9th May, but these being either single birds or lone pairs, were obviously stragglers. It can safely be said however, that the migration of this Raven to Upper Sind begins in late September and lasts till late March, and that quite a number of birds remain to breed in selected localities beyond their permanent habitat, to which they return for the hot weather after rearing their young.

Why birds which remain to breed and even those which are purely winter visitants fail to make a permanent abode in parts of Sind, which afford a habitat similar in many respects to the lower Punjab, where this Raven is a permanent resident, is a puzzle. The intense heat of Upper Sind and lack of rainfall may be reasons, but on the other hand the southern Punjab can be just as hot, though the rainfall I think is better, as is definitely, the irrigation system, factors which make conditions very different to what they are at present in parts of Upper Sind not affected by the Sukkur Barrage.

Since I met this Raven so frequently in the northern *talukas* of Nawabshah district in 1935, it may in time extend to suitable tracts along the whole of the Sukkur Barrage Canals system and perhaps the favourable conditions created by perennial canals, between Sukkur and Hyderabad, will result in this Raven being less localised in Sind than it is at present. May this be so, as the Punjab Raven is a useful, handsome and interesting bird.

KARACHI, K. R. EATES,
October 27, 1938. F.Z.S., M.B.O.U.
Indian Police.

XIV.—A NOTE ON THE RESIDENT OWLS OF SIND.

1. **Tyto alba stertens** (Hartert). The Indian Barn Owl.

The Indian Barn Owl is rare in Sind. Hume met with it at Larkana, Scrope Doig and Butler at Hyderabad, and Ticehurst at Karachi, while Culbertson obtained a clutch of eggs from the river banks at Malir in Karachi district.

I first came across this owl in January 1923, in Karachi, where a pair had their home in the dome of the D.J. Sind College, and till 1928 frequently met either one or both of them in Burns Garden or in the vicinity of the college itself. They moved about freely after dark and rent the stillness of the night with their unearthly screeches.

During the summer of 1925 a pair took possession of a corner turret of the old Chartered Bank building, one of the oldest buildings of modern Karachi, but something disturbed the birds, probably my prying into their private affairs, and they deserted the place in October the same year.

On the 25th April 1928 I came face to face with a full grown bird in perfect plumage hopping sedately up the main stairway of the City Police Quarters, a four storied block with a tower, in the heart of the city. On seeing me, the bird flew up on to a cross-beam at the top of the stair-tower and gave me a look as much as to say, 'What the devil are *you* doing here'. I stared at him till I got a crick in the neck, and that night left the tower window open. The next morning he had gone, but had left behind, as a souvenir perhaps, a solitary pellet consisting of the bones of what appeared to be a small rat and some bird, possibly a sparrow.

On the 20th December 1929 I came across a pair in an old Kubh, on a spur of the Makli Hills at Pir Patho, Karachi district. This pair evidently had eggs or young in a recess, about 30 feet high, in the cracked and tottering wall of the Kubh, as the female (presumably) was sitting close, while her mate sat in stony silence on a brick ledge near by and calmly looked down at me.

Both birds flew out on being disturbed but an hour or so later were again in the Kubh, one in the recess scarcely visible, the other on the ledge, peering down at me in the way owls have. The nest was too risky to take so I left the birds to continue their vigil over the thousands of graves surrounding the Kubh and littering the whole spur, at the extreme end of which overlooking a bend of the Bagar canal, was that 'holy of holies', the shrine of Pir Patho, which is still reverenced by Muslims and Hindus alike.

I did not come across this owl in Hyderabad district in 1929, or in Sukkur, Jacobabad and Nawabshah districts from 1930 to 1935. In February 1936, however, I found a pair occupying an old Rest House at Mirpurkhas, Thar Parkar district. The floor under the cross beams on which the birds sat was strewn with pellets, which contained mostly the bones of small rodents. I looked for a nest and found a suitable recess which may have been used as one the year previous. It contained nothing.

At nights I often came across either one or both of these birds on the outskirts of the town, my attention being attracted by their ear splitting screeches.

In June 1936 I saw a captive bird sharing a cage with a Dusky Horned Owl in the Karachi Zoo. Both birds looked very miserable and unhappy. In May 1938 I saw a bird on several occasions at dusk in the vicinity of the G.P.A. Hall. It, like the others I have met, appeared to take a delight in screeching when on the wing.

2. **Ketupa zeylonensis semenowi** (Sarudny?) The Arabistan Brown Fish Owl.

The Fish Owl is one of the rarest owls in Sind. I have come across it but twice in 18 years and was lucky enough to obtain an egg on my first acquaintance with it. Ticehurst did not meet with it, but records East Narra, Larkana, Gaj River and Jungshahi as localities where it has been obtained.

In the plains of Sind it is only met with in riverain, canal and dhand tracts, where there are large leafy trees which afford close cover. In the hills it is probably confined to the rocky gorges of more or less perennial streams, such as the Gaj-i-Nai, Sita Nai and the Baran river, where shade and shelter are available.

On the 29th December 1922, between Talhar and Palh in the Hyderabad district, I stumbled across a small deep dhand, growing dense thickets of tamarisk and *sar* grass, the place was teeming with Lesser Whistling Teal. In the vicinity were several great *siris, pipal* and *bar* trees. While resting in the shade of an immense *bar* tree I noticed a partly eaten mud fish on the ground below and a careful search among the leafy branches above revealed a Fish Owl taking quiet stock of me. Realising that its mate was 'In' somewhere on the tree, I flung a clod of earth at the only likely place, a junction of massive bifurcating boughs, and out, to my joy, flew another owl. I was up that tree, which was luckily easy to climb, in less time than it takes to tell, and found, in a hollow formed by branching boughs, a single, perfectly fresh egg. The nest hollow contained some mud, small clods of earth, a few dried *bar* sticks and *bar* leaves, fish bones, the remains of a Whistling Teal and some feathers, mostly Pond Heron and Whistling Teal. Thinking I would be able to visit the place again and secure not only the birds but also a full clutch of eggs, I left the birds in peace, but as ill luck would have it, I was transferred to Karachi shortly after and so do not know whether the single egg I have is that of *semenowi* or *leschenaulti*.

On the 10th March 1936, about 14 years later, I came across another of these owls, which did not appear to be quite full grown, seated on a shady tree on the bank of the Jamrao canal near Jheluri, Thar Parkar district. On the 16th of the month I was again in the locality, this time with a gun, but failed to find the bird. Unfortunately I did not have the time to thoroughly search all the thickly foliaged trees along *both* banks of the canal.

3. **Bubo coromandus coromandus** (Lath.). The Indian Dusky Horned Owl.

The Dusky Horned Owl, which is found throughout the plains, in forest, riverain and canal tracts is by far the commonest Horned Owl in Sind. I have met with it frequently in suitable habitat in *every* District in the Province.

It breeds from December to February, but few fresh eggs will be found after the middle of January. As a rule it appropriates an old nest, generally that of a Pallas' Fish Eagle or a Vulture. On several occasions I have taken eggs from a deserted Kite's nest.

During the breeding season both sexes are exceedingly noisy and call, one answering the other, both night and day.

During the first week of November 1935, a pair took possession of an old kite's nest on a Kandi tree in a thick clump of other large trees in the compound of the D.S.P.'s bungalow at Nawabshah. The birds were very noisy at all times, but more so at night. As a rule the female occupied the nest, while her mate sat stolidly in a *siris* tree near by. Their diet was varied, as from time to time I found the remains of ring doves, crows, a roller, a pond Heron, rats, a squirrel and a huge frog on the ground below the 'homes' of these two birds. Only on one occasion did I see them mating, it was late in the evening, in the nest itself, and judging from the row that went on at the time, and that often heard at night, mating apparently took place, on occasions, several times during a night. On the 14th December the nest contained two perfectly fresh eggs. The birds on losing their eggs moped a bit and left the locality for a short while. They did not however go far, as they were still heard at night. They returned within a few days, more noisy than ever and once again took possession of the deserted kite's nest. On the 31st December, my last day in Nawabshah, I sent a man up to the nest, about 40 feet high, and he reported that the nest contained nothing except mud and some clods of earth. Two fresh eggs however were taken on the 17th January, 17 days later, and sent to me by a friend, who packed the eggs so carelessly, in spite of detailed instructions, that they were both broken in transit.

I have taken quite a score of nests in Sind and one in the U.P. and have always found this owl in possession of a deserted nest, that of an eagle, vulture or kite. On the ground below and sometimes in the nest itself lie the remains of past meals.

On one occasion I found the remains of a leveret, on another, those of a monitor lizard. Ticehurst records that T. R. Bell found two dead porcupines in a nest.

In Sukkur district I found one of these owls, on a river bund at dusk, devouring a freshly killed Brush-tailed Rat. A *Mohano* told me that he saw one of these owls catch and eat a fish about a foot in size. I have at times found fish bones below a nest, but not often. To a Sindhi an owl is either a *Gug* or a *Chibiru*. As the term *Gug* is applied indiscriminately to all large owls, the owl the Mohano saw may have been a Fish Owl. He said that it pounced upon the fish in shallow water and flew off with it in its talons.

He could not see what fish it was, as it was getting dusk, but thought that it was a mud fish.

4. **Bubo bubo bengalensis** (Frankl). The Indian Great Horned Owl.

The Great or Rock Horned Owl though not often met with in the plains is not uncommon in dry, hilly tracts, where there are ravines, *nullahs* and dry water courses with high banks. I have met with it in such localities in Karachi, Sukkur and Thar Parkar districts.

Culbertson took a clutch of 4 fresh eggs in December, which he found in a depression at the foot of a mango tree on the banks of a canal at Badin, Hyderabad district. In March 1924 I took 2 eggs from a hole in the bank of a dry water course near Jungshahi, Karachi district. In Sukkur district I came across two nests, one in an old Kubh (February 1930), and the other in a ravine (March 1931). Again in February 1936 I found a nest with 3 young in a hole in the side of a *nullah* in some sand *bhits* near Umarkot, Thar Parkar district.

A note on the distribution and nidification of this owl in Sind, appears in vol. xxxix, No. 3, page 631, of the Society's *Journal*.

5. **Otus bakkamoena deserticolor** (Ticehurst). The Sind Collared Scops Owl.

The Collared Scops Owl which is by no means uncommon in Sind is met with in suitable places throughout the Province.

Owing to its habit of lurking by day, it is more often heard than seen. Its soft 'ūk-ūk-ūk', repeated at intervals is most often heard during the stillness of the night. This little owl is partial to forests and topes, but nevertheless is met with in gardens, on canal banks and road sides where there are suitable trees.

It loves to sit, looking for all the world like a little gnome, well concealed amongst the leafy branches of some densely foliaged tree, the mango being a favourite.

I have come across it frequently during the past 18 years in every district in Sind and have taken nests with either eggs or young in Karachi, Hyderabad and Sukkur districts. It breeds from February to April, both months inclusive. I have taken fresh eggs in early February, March and April from holes in mango, *kandi* and *lai* trees. Butler took a nest in Hyderabad in April. T. R. Bell records finding a nest in a hole in the bottom of the foundation of a deserted *Neophron's* nest in a large white poplar. I have never found more than 4 eggs in a nest. As a rule the eggs are deposited on an apology for a nest lining in the way of a few feathers, grass stems and dried leaves. The eggs as a series, are larger and more spherical than those of the Sind Spotted Owlet.

At Mirpurkhas I saw one of these owls mobbed by a crowd of White-eared and Red-vented Bulbuls. The Scops was decidedly 'hot and bothered', and how he did not twist his head off trying to face the chattering attacks of his tormentors launched simultaneously from all sides was a wonder. The noise attracted a family of Jungle Babblers, who added their shrill abuse to the shower of invective overwhelming the unfortunate Scops from every direction. He stuck it stoically for some minutes and then made a dash for the shelter of a leafy pipal tree, followed by his horde of tormentors.

Harrington Bulkly took a nest of this owl on the 1st March in the Pabb Hills, in Las Bela State.

6. **Otus brucei** (Hume). The Striated Scops Owl.

The Striated Scops Owl is rare in Sind and has seldom been met with, nevertheless I am inclined to believe that many a bird is missed on account of its lurking habits and that, to some extent, it is resident and breeds. Blanford obtained a pair east of Umarkot, Thar Parkar district, in January; and Scrope Doig one at Hyderabad in December.

I have met with it but thrice in 18 years, at Khebar, Hyderabad district, 12th March 1929; Taror, Sukkur district, 30th December 1930 and Karachi 28th March 1932. At Khebar a single bird was found seated in a leafy mango tree. I searched for the pair but was unable to locate it. In a tamarisk belt in a valley between sand *bhits* near Taro, I noticed one of these owls peeping out of a hole in an old *lai* tree. The hole contained some feathers and dry *lai* leaves but no eggs.

At Karachi, a single bird chased by House Crows took shelter in an upper storied flat in Civil Lines. It was caught and sent to me. I kept it caged for some days but as it refused all food, in the way of crickets, cockroaches and black beetles, and began to droop, I gave it its freedom. I feel sure that a systematic hunt for this Scops Owl in suitable localities during the breeding season would prove that it is more elusive than rare, and that it breeds in Sind.

7. **Athene brama indica** (Frankl.). The Sind Spotted Owlet.

This Owlet is by far the commonest owl in Sind and is met with everywhere, throughout the Province. It breeds in February, March and April, laying as a rule in holes in trees and buildings. In the hills around Khadeji, Rehri and Bram Hyderi in Karachi district, it breeds in holes in cliffs and the precipitous sides of gorges and water courses. I have also found eggs or young on several occasions in deserted crows' nests, and once in a hole in the side of a small quarry; while in Sukkur district several pairs had their homes in natural holes in solid stone, great masses of rock, in the old bed of the Indus near the ruins of Aror. The nest lining which is generally very meagre, consists of a few feathers, grass stems or dry leaves.

Three to five eggs are laid, in most cases four and these as a rule are found, like most owls' eggs, in all stages of incubation, due presumably to the irregular intervals at which they are laid and the habit this owl in particular has of holing up during the day, with the result that incubation begins, intentionally or otherwise, from the time the first egg is deposited. It is not unusal to find both female and male in a nest containing eggs. On one occasion I rooted out three full grown birds and their parents, five in all, from a hole in a mango tree.

In the U.P. this bird is most appropriately named, *Khus-kutkuttia*, and in Upper Sind I have heard Seraikis call it, also appropriately, *Chugal-chiri*. It is surely needless for me to explain why. In Sind, the name *Chibiru* is applied indiscriminately to it and all other small owls.

KARACHI,
October 26, 1938.

K. R. EATES,
F.Z.S., M.B.O.U.
Indian Police.

XV.—VULTURES FEEDING AT NIGHT.

I have heard it said that vultures will occasionally feed on a carcase at night, if there is a moon; but I cannot remember having actually observed this myself, so the other night out of curiosity I went out after dinner at about 9 o'clock to visit the remains of a cow that lay on the hill side below my cottage.

The moon was about three-quarters full, but misty clouds reduced visibility. The carcase of the cow at which the vultures had been feeding on during the day time lay on the open hillside, but round it on two sides was fairly thick cover-bushes and long grass, and the ground fell away below it to pass into a bushy ravine. As there had been a leopard about recently I took a shotgun and electric torch.

Coming to the carcase I passed within twenty yards of it screened by bushes, and as I did so, I heard the vultures on the remains. They were apparently actively feeding on it as they were hissing and apparently squabbling over it. I took a half turn round it and suddenly appeared some ten yards from the carcase and flashed my torch on it—though it was hardly necessary to do so in the moonlight. There were about fifteen vultures gathered all round the body and they stretched up their heads and necks to view the intruder. They consisted of White-backed Vultures and the Northern Long-billed Vultures in about equal numbers. There was one Black Vulture among them though three had been at the carcase during the daytime.

They then began to leave the carcase flying off downhill towards the ravine—one by one—some pitching again on the hill side nearby. But one of them a White-backed Vulture crouched—drawing his neck in and depressing his head as if trying to hide himself and refused to go. I went right up to him and poked him with the muzzle of my gun! He then made a short flop of a few yards down the hill where I left him in the grass. It is possible that he was injured in a fight with the cthers or with a piedog during the daytime.

What would a leopard have done had he come to this 'kill'? Do leopards and tigers ever kill vultures in order *to eat them*? I have seen a tiger in the daytime spring up from his 'kill' and jump up at the vultures but he did not get one. That was apparently only to drive the vultures off.

On the other hand I shot a leopard who was in the habit of climbing the big Banyan trees to eat the young vultures in the nests! Was that an exceptional depravity—or is it not unusual?

I am now of the opinion that vultures will feed by moonlight if they are not afraid to come to ground at the carcase. That we never see them do so when waiting up for tigers and leopards is no doubt from their fear of the big cats and other night prowlers.

Many interesting questions arise from this observation. What species of vultures are given to feeding by moonlight? How much moon must there be to tempt them down? Do they feed ever when there is no moon? It should be possible to test their sight by night at any Zoo where they are held captive . . . and also their sense of smell . . . has that ever been investigated?

TAUNGGYI, S.S.S. T. R. LIVESEY.
BURMA.
October 4, 1938.

XVI.—THE STATUS AND NIDIFICATION OF THE PERSIAN BEE-EATER (*MEROPS PERSICUS PERSICUS* PALL.) IN SIND.

The Persian, or rather Iranian Bee-eater is an early summer migrant to Sind, where it breeds in suitable localities, freely in some places, sparingly in others.

Thousands of birds enter the Province yearly, numbers remain to breed, others pass on into Rajputana, which so far as I am aware is the limit of its extension east.

The route through Sind embraces the whole Province, from Kashmor in the north, to Karachi in the south. The general direction of migrating birds is always towards the east and birds any distance away from their regular breeding haunts fly very high, except when feeding.

Birds as a rule begin to arrive in Sind in late April or early

May, the movement continuing till the end of the month and at times extending into early June. Early arrivals may be met with in middle April.

Butler records it on the 16th April. I have not met with it in any numbers earlier than the 27th April. The majority of birds however are seen during the first half of May. Birds forming the eastern fringe of the movement are often carried out to sea and these on returning to the coast line, take a north-easterly route over the creeks and mangrove swamps *via* Bram Hyderi, Jari, Petiani and Keti Bunder towards Thar Parkar, where I am told they breed in the sand *bhits* in the desert tracts of the district, which extend into Rajputana.

Birds in flight attract attention by the habit they have of chirping to each other, and the peculiar call notes when heard during the silent hours of the night, just before dawn, are most pleasing to the ear. From my yearly Rough Notes I find that migrating birds have been heard or seen from 4-30 a.m. to 9-30 a.m. and from dusk to 11-40 p.m., so it's fairly evident that they rest or feed during the heat of the day, which is intense in Sind during May and June, yet this Bee-eater builds as a rule in most hot, arid tracts, where there is no water except that in canals, the full flow of which is somewhat later than the arrival of the birds. Butler found it at Hyderabad in July, and Scrope Doig thought that it bred in July and August in the Eastern Nara district. Ticehurst received a breeding bird from Draklan near Kashmor in May, and Gordon came across it around Jacobabad and at Kubo on the Desert Canal in June, where it was plentiful.

During my stay in Sind, now 18 years, I have met with this Bee-eater, at suitable times of the year from Karachi to Kashmor.

In Karachi district, where there are no suitable breeding grounds, it is met with only as a bird of passage.

On its arrival in early summer it tarries but to rest and feed, and passes on, flying high, to its breeding haunts on the eastern borders of the Province and Rajputana.

Numbers of birds however remain in suitable places in Middle and Upper Sind to breed, the majority continuing east to their regular breeding grounds. It arrives again in Karachi district in late August and September and numbers, more young birds than adults, may be met with in the vicinity of *dhands*, where they perch on *pan, sar* and *lai* and delight in hawking the numerous winged insects which infest the *lai* thickets and reed beds, which are to be found in the majority of Sind *dhands*. Around Karachi itself they are seldom met with on their return, and when seen or heard, are flying high, towards the Persian Gulf or Baluchistan.

Personally I believe that these flights, which pass over Karachi in October and early November, are on their return passage to Iran and Irak, and that this Bee-eater returns to these countries by the end of November, as, to the best of my knowledge, none have been met with anywhere in Sind from December to mid-April.

The reason why more of these autumnal or return flights are not seen is due probably to the great height at which the birds fly.

My attention has invariably been attracted by the call notes and even with these as a guide I have often found it difficult to spot the birds and have often failed altogether to do so. Even when located, few, comparatively to the numbers heard, are actually caught sight of.

In Sukkur district in 1930 I came across great numbers of this Bee-eater *en route* to their breeding grounds in late April, May and June and on the 28th August the same year found hundreds of adults and young hawking over Ghari *dhand*, then an immense sheet of water with great reed beeds and thickets of *lai* and *sar*. The birds which were scattered over an area of several square miles permitted an easy approach and I was able to watch them gracefully hawking insects at very close quarters.

The next year I was able to follow up my observations and on the 12th June was rewarded by discovering a small colony digging nest holes in a high bank of the Kalandar Shak, Mirpur Mathelo taluka. I also came across in the same taluka, many birds in small parties of a dozen or so around Yaro Lund, Sahib Khan Lund and the Raini Wah. The majority of birds however appeared to be making their way to some sand *bhits*, which I could just see in the dim distance further east. On the 25th June I found a small scattered colony near Detha Bhaya, breeding in low sand *bhits* and mounds near the Mahie Wah. I dug out several nests, some quite 4 feet deep, but was too early for eggs. On the 6th July I came across a few pairs, which were obviously breeding in some sand *bhits* at Nur Shah-jo-Bhit in the Rohri taluka but did not have the time to look for nests. The 11th of the same month found me at Khenju, in Ubauro taluka, near the Rajputana border, where I found quite a large but scattered colony breeding in the banks of a *Kario* and in sand *bhits* in the vicinity. I dug out a number of nests and collected 23 fresh eggs, some of which I sent Mr. Stuart Baker. No nest had more than five eggs or young. In one nest we found only three callow young, in another the largest Saw-scaled Viper it has been my lot to see, and I have seen scores. This particular specimen measured a trifle over 26 inches in length and almost 4½ inches in girth. It had dined on five callow young. Incidentally it was its last meal. Men with me, who live in tracts where this Viper abounds said that they had never before seen such a large *lundi*, a name by which this viper is known in Upper Sind, meaning 'bob-tailed'.

The nests dug out varied in length from 3 to 6 feet, the egg chamber being quite large enough for a bird to turn round in when seated.

In one case we caught a sitting female by placing an *ajrak* (sheet) over the nest entrance and thumping the ground above. The bird, a female with a well marked incubation patch was given to W. H. Cole, who had not a specimen in his collection.

On my return, I was able to revisit the small colony at Kalandar Shak on the 14th July. I dug out two nests, one containing five, and the other four eggs.

The year following I saw many birds flying over Sukkur and met with them at Duber, in Rohri taluka and in talukas further north where I had met them the year previous.

In July and August 1934 I came across this Bee-eater from Ghari Khairo to Kashmor in the Upper Sind Frontier (Jacobabad district), and on the 20th July found a scattered colony of about two score birds breeding in the banks of an old Kario and in mounds in semi desert between Thull and Tangwani. In September birds were still to be seen along the Desert and Begari canals but were fewer in numbers.

At the end of November I failed to meet with it anywhere.

In Nawabshah district I saw many birds in flight in May and June 1935. On the 9th May a single bird passed over Nawabshah, shortly after a terrific dust storm.

It was calling loudly and evidently had been separated from the flock during the storm. It was obviously in distress but struggled on manfully in a north-easterly direction, calling pitifully at short intervals.

Near Tharushah on the 14th July I came across about a score of birds in pairs or single in suitable breeding ground alongside a canal, but did not have the time to look for nests. I also found a small scattered colony in a similar situation along the Rohri canal, near Saurie about 35 miles from Sakrand, but here also I did not have the time to look round for nests, the predominance of single birds however told a plain tale.

When at Umarkot in Thar Parkar district in February 1936, a Meghwar *shikari* informed me that numbers of this Bee-eater arrived in the district in May and bred in the sand *bhits* throughout the desert portions of the district.

This bird is well known in Sind as 'Wado Tracalo', and the smaller species, the Sind Green Bee-eater (*Merops orientalis beludschicus* Neum) as 'Nando Tracalo'.

KARACHI,
October 10, 1938.

K. R. EATES,
F.Z.S., M.B.O.U.
Indian Police.

XVII.—HAUNT AND HABITAT OF *PITTA C. CUCULLATA* HARTL. IN WEST BENGAL.

(*With a plate*).

During an excursion in quest of breeding birds to Satgachia (District Burdwan), which lies 20 miles east of Burdwan town, on 23rd June, 1935 I came across a pair of *Pitta c. cucullata* Hartl., one of which was captured with the aid of a bird-catcher who happened to be with me. The occurrence of this species is unknown in Western Bengal, and it is therefore of interest to record the circumstances connected with my excursion.

The location of Satgachia is attractive in many ways, but apart from its physical peculiarities which are described below, and its accessibility by motor road, the fact that an acquaintance lives there, whose repeated invitation for my visit to his country bore pointed reference to the prospect of an almost untrodden field from a bird-collector's point of view, was enough inducement for this excursion. An exceptionally protracted summer, however, with its attendant discomforts made an earlier trip impossible. A few showers having occurred preliminary to the breaking of the monsoon which helped to bring down the temperature I found my opportunity and at once decided to come out. The trip was made on June 23, 1935 in my motor car. The drive *via* the Grand Trunk Road was at once enjoyable and instructive, as I had a chance of looking at the countryside, which embraces long stretches of the contiguous districts of Howrah, Hooghly and Burdwan. The approach to my destination lay through a feeder road, which takes off from the main road at mile 56. As I reached the outskirts of Satgachia I perceived a difference in the outlook, specially in vegetation and in the upward trend of the level of the land. The thickets and scrub-jungle on the bed and along the banks of the river Banka arrested special attention and I obtained a few interesting species from this locality, e.g. *Pycnonotus luteolus* Less. (reported in *J.B.N.H.S.*, xxxviii, 620-21, 1936). The neighbourhood, to the north, alongside the Kalna Road reveals other interesting spots overgrown with scrub jungle, where I was busy collecting in the afternoon. My prospect was about to be marred, however, by the gathering clouds which so overcast the sky that I felt inclined to return, when I heard from a short distance some loud notes, very like those of the Indian Pitta, which is not uncommon in Bengal. Following these sounds, I reached an orchard at the far end of a low-lying and grass-covered field bordered with bamboos. It seemed less frequented and was overgrown with fruit trees interspersed with patches of scrub and prickly thickets. Here as I anticipated, I came upon, a pair of *Pittas*. In the approaching gloom of the evening made darker by the thickening clouds, I could hardly discern them clearly, but what little I saw of them left me in no doubt as to their behaviour, which was evidently of courtship,—erect posture with characteristically Pitta-like movements of the body and tail, and loud impetuous calls, uttered almost alternately by the couple. As I came closer I saw clearly on the ground two moving figures, hopping about and almost challenging each other by gesture and voice. On my approach they flew up to a mango tree. I set my catcher on to them and, in a minute one was caught. To my utter surprise I found it to be a *Pitta c. cucullata* Hartl. The rain had now burst with terrific force, making me retreat for shelter, and when it stopped, full thirty minutes later, my search for the second bird proved in vain. For it was too late then, and no clue was found as to any possible nest of the Pitta in the neighbourhood. The exquisite condition of plumage of the captured specimen, its time of occurrence and incidental behaviour bespeaking courtship display, suggests that it is obviously a breeding species of the locality. It has since been thriving in my aviary.

Measurements: Wing 114 mm., tail 42 mm., tarsus 43 mm., culmen 23 mm.

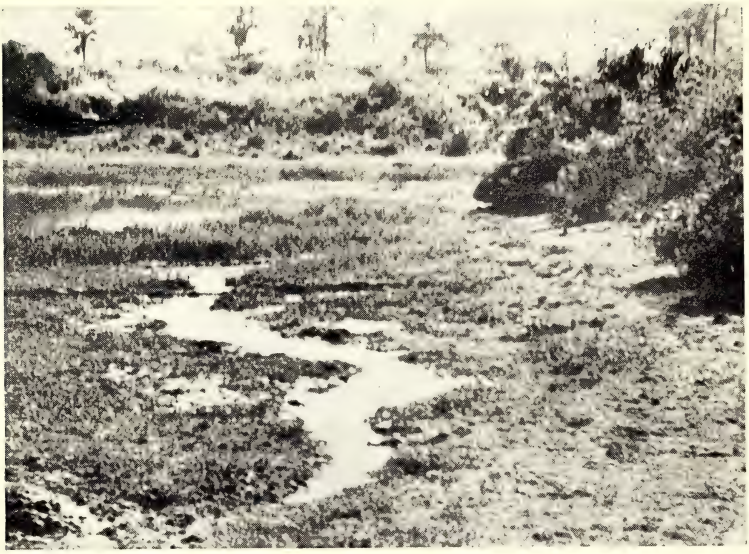


Fig. 1.—Swamp and marsh fed by overflow water of the river Banka.

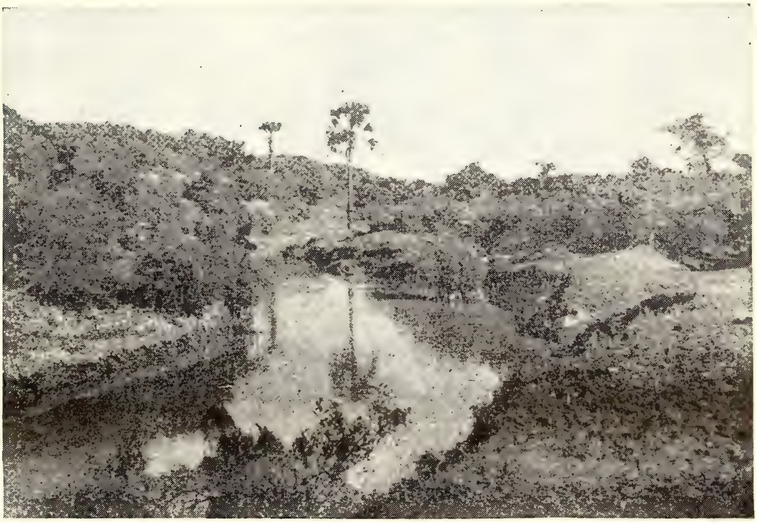


Fig. 2.—Aspect of the 'transition belt' along the course of the Banka. Stretches of waste land overgrown with scrub- and bush-jungle.

It is remarkable that there is no record of this species from any part of Central and Western Bengal, although it is found to occur in Eastern Bengal, e.g. in Chittagong, Noakhali, Tipperah and Mymensingh. It is common in the hills of Jalpaiguri, but in North Bengal generally it appears to be a breeding species both in the hills and plains. It is also known to breed in some places in the plains of the United Provinces. The species does not seem to be exclusive in its choice of habitat, occurring as it does in different haunts and situations, both in the hills and plains. Mr. Stuart Baker writes, 'it frequents forest of all kinds, the deepest and wettest as well as the driest and thinnest, while it may also be met with in bamboo-jungle, scrub-jungle, and in crops, such as mustard and rice, or in cultivation outside forest.' In its habitat in the plains it appears to affect cover, tree- and bush-jungle, orchard and overgrown waste land. Shy and always alert, it rarely shows itself in the open. The orchard and tree-grove in Satgachia in the district of Burdwan where I found the Pittas offer cover, shelter and seclusion sufficient for their mode of life, while the neighbouring bamboo-clumps, prickly thickets and undergrowth apparently provided additional attraction to the breeding pair.

Mention is necessary of the fact that Burdwan, due to its peculiar physical features, naturally resolves itself into two distinct areas, entirely different from each other. The whole of the western part and an inconsiderable area to its east have a marked affinity to the rocky, non-alluvial plain of Chota Nagpur, while the remaining eastern portion, in which Satgachia lies, presents many features of homogeneity with the districts in the neighbourhood of Calcutta, e.g. Hooghly and 24-Parganas. Ecologically this tract, which forms a rather narrow belt of alluvial land, may be regarded as a continuation of the Gangetic delta with patterns of vegetation characterising Central Bengal. The climate is moist and equable. The mean maximum temperature in the dry season (December to April) varies from about 80° to 101°, and remains steady at about 90° in the monsoon months. The total average of rainfall between May and November amounts to 53 inches. While these physical conditions are to a great extent reflected in the topography of Satgachia, its proximity to the more open, undulating, rocky and arid zone cannot altogether leave it impervious to its influences. Nor is it difficult to detect in or around this area evidences of a process of transition whereby the rocky soil merges into the alluvial tract. An impetus to such merging may be looked for in the action of the river Banka, which traverses the whole of this tract, it being originally a spill channel of the Damodar which is pre-eminently a hill-fed stream, bringing down vast quantities of silt from the Chota Nagpur plateau. How far this reacts on the flora and fauna of the locality requires careful investigation, but it is apparent that while the characteristics which it shares in common with the rest of the Gangetic delta remain more or less constant, minor modifications have crept in under stress of circumstances and environmental factors, which tend to invest it with features peculiarly its own. These are manifestly of interest and importance, for, ornithologically, they appear to induce an influx of species not ordinarily attached to a habitat in the deltaic region of Central Bengal. The salient features of the locality are noted below :

1. Mainly alluvial country typical of the rice plain of the Gangetic delta, featuring low water-logged areas as well as high lands; the latter harbouring hamlets and villages while the former give rise to swamps and *jhils* covered with tall grass, marsh weeds and sedges characteristic of the Gangetic plain. Extensive marshes lying near the banks of the *Banka* are sustained by the overflow of that river.

Absence of genuine forest, though a certain amount of jungle including genuine forest trees, e.g. *Sal* (*Shorea robusta*) has grown up through depopulation of villages or abandonment of sites formerly inhabited. Orchards and tree-groves mixed with shrubberies of semi-spontaneous and sub-economic trees and shrubs are found in abundance, while trees grown to a gigantic height line as a rule the roads and highways.

2. What may be called the 'transition belt' lies some distance off to the north and northwest, along the course of the river *Banka*, and in a marked degree on its northern bank, where the peculiar soil deposits bear evidence of transfusion of rocky decomposition with deltaic alluvium.

A rugged and rather open tract, devoid of tree-groves in striking contrast to the rest of the locality, where vegetation is unimportant and mostly uneconomic and of stunted growth. Scrub- and bush-jungle abounds in this belt, pre-eminently featuring the flanks of the river Banka and the stretches of waste land around, the tangled hedges and prickly thickets lying buried in overhanging creepers and various milk weeds.

50, KAILAS BOSE STREET,
CALCUTTA.
September 8, 1938.

S. C. LAW.

XVIII.—ON THE OCCURRENCE OF THE INDIAN PURPLE MOORHEN (*PORPHYRIO P. POLIOCEPHALUS*) IN CHITRAL.

I enclose the skin of a Purple Moorhen (*P. p. poliocephalus*) shot today in Mastuj. As apparently no one has previously seen a bird of this species in Chitral, I thought it might possibly be of interest to you.

CHITRAL SCOUTS,
CHITRAL,
N.W.F.P.
November 17, 1938.

H. S. STANSFELD,
Capt., Chitral Scouts.

XIX.—ON THE OCCURRENCE OF THE BANDED CRAKE (*RALLUS E. AMUROPTERA*) AND THE MALABAR WOODPECKER (*MACROPICUS J. HODGSONI*) IN THE BILLIGIRIRANGAN HILLS, S. INDIA.

It may be of interest to record that a young specimen of the Banded Crake (*Rallus eurizonoides amuroptera*) was killed here in the middle of August. I should like to know whether the Banded Crake has previously been recorded at this altitude (Billigirirangans, Central South India—5,700 ft.).

The Malabar Woodpecker (*Macropicus javensis hodgsoni*) is now fairly common here, although I am sure it did not occur on the Billigirirangans some years ago. I think records todate place this bird on the Western Coast, from Travancore to Belgaum.

Honnametti Estate,
Attikan—Mysore, P.O., R. C. MORRIS.
S. India.
September 20, 1938.

[Mr. Morris' note adds to the few records of the occurrence of the Banded Crake in Southern India. No examples of this bird were obtained by the Society's Surveys in this region. The bird occurs in the Sub-Himalayas and from east to west and ranges southwards in smaller numbers in the Western and more wooded parts of Peninsula India. The extension of the range of the Malabar Woodpecker to the central hills of South India is interesting. Previous records are confined to western ranges of the Presidency.—Eds.]

XX.—THE BREEDING OF THE INDIAN SOOTY TERN (*STERNA FUSCATA INFUSCATA*) IN THE LACCADIVE ISLANDS.

I send herewith 4 eggs and would be very grateful if you could help me in identifying them. They are the eggs of Oceanic Terns of apparently two species and were collected in May on Putti Sandbank in the Laccadive Group. As breeding had not begun when I visited the Islands last February, I left word asking for specimens of eggs from the tern colony to be taken when obtainable and if possible skins also of the breeding birds. Unfortunately the latter have not been forthcoming, so that I am afraid certain identification is impossible.

Coovercolly,
Somwarpet, F. N. BETTS.
Coorg.
October 10, 1938.

[Mr. Stuart Baker to whom the eggs were sent for identification writes as follows:—

'The eggs taken during May in the Laccadives by Mr. F. N. Betts are undoubtedly those of the Indian Sooty Tern (*Sterna fuscata infuscata*) and are all of the same species; the largest and smallest of the 4 eggs sent come well within my *maxima* and *minima* measurements. The eggs of this bird vary in the most extraordinary way in colouration and very greatly in size. Hume found Sooty Terns breeding in the Laccadives in February when there were well grown chicks as well as hardset eggs and from this we could infer that one egg laying season lasted from December to February. Now it is interesting to have a second laying season recorded for May. Although we have no doubt ourselves that the eggs belong to our Indian form, it would be desirable to get some specimens of the birds to confirm this',—EDS.]

XXI.—MIGRATION ROUTES OF GEESE.

Perhaps the following information may be worth while placing on record. Over the village of Dambuk in the Sadiya Frontier Tract lies what must be in Assam one of the chief migration routes of Geese on their way to and from their breeding grounds. I was twice lucky enough to see this migration flight, in 1934 and again in 1936. It appears to start as early as the middle of January, and goes on until the end of March. The beginning and middle of March seem to be the peak periods for the northward migration. Dambuk lies right at the foot of the Hymalayan foothills which rise to between 5,000 ft. and 6,000 ft. immediately behind the village, gradually rising still higher as one goes further north; nothing but a jumbled mass of mountains. The valley of the Dibang river is some little distance to the east, whilst that of the Dihang (Brahmaputra) is roughly thirty miles to the west.

In 1934 I was at the village for the first week of March, and from about 4 o'clock in the afternoon every day until late at night gaggle after gaggle of geese appeared at intervals of about fifteen minutes from the south and south-west, flying at an altitude of about 4,000 ft. to disappear over the saddles in the hills towards the north behind the village. Their 'honking' sounded very melancholy as if they did not relish the thought of the inhospitable country over which they had to fly for there is nowhere en route where they could possibly alight.

Thousands of birds must have passed over each day I was there and when one woke up during the night the birds could still be heard going over.

Apparently there must be at the sources of the Dibang on the Great Snow Range some very convenient passes which the birds make regular use of. By far the bigger valley is that of the Dihang where my headquarters were at that time; but not a single goose ever went north by this route. I toured along the foot hills for a hundred miles during several migrating seasons; but never anywhere else did I see even one per cent of the number of birds going north that I saw at Dambuk.

In 1936 I was there from the 11th to the 13th of January; but the migration had evidently only just started and very few gaggles were seen. On the average only two or three gaggles of 25 to 30 birds each were passing northwards each day I was there. The birds were at too great a height for even a guess at their species. Dambuk is, I should mention, some 25 miles or more from the nearest point where geese are usually found and there is dense jungle between.

This migration route appears to be a very old and well established one, for the Abors have a legend that on their northward flight the birds are advancing with war cries to make war on the Musk Deer, whilst when they return they come with shouts of victory after sucessful combat! Unfortunately I have never been able to see the southward migration.

GAUHATI,
KAMRUP DISTRICT,
ASSAM.
October 16, 1938.

R. E. PARSONS.
Indian Police.

XXII.—COTTON TEAL (*NETTOPUS COROMANDELIANUS*) AT NASIK

This bird was a single female (no others were seen) and was shot on Lake Beale, near Ghoti, about 20 miles South West of Nasik, on January 2nd. I regret the skin was not preserved, but a careful examination was made, in comparison with the description and illustration found in *Game Birds of India* by Stuart-Baker, and there is no doubt whatsoever as to the identification.

NASIK.
January 3, 1939.

C. J. RAE.

XXIII.—'FISH OF GREAT AGE'.

(*Reprinted from the 'Field'*).

SIR,—With reference to the above article by Mr. T. C. Bridges, in the *Field* of October 22nd, it is worthy of interest that the majority of modern ichthyologists appear to be of the opinion that 'centenarian' carp are non-existent; that, in fact, they never have existed. According to the *Fishing Gazette* of May 25th, 1935, a German scientist, Professor Rochner, who has studied carp for many years, states that they 'live twenty-five to thirty years only. The ancient carp of Fontainebleau are a legend . . . for the ponds there were emptied in 1789, in 1825, and again during the Commune. The monster carp there, 90 centimetres long and 60 in girth, is only twenty-five years old.'

In his *History of Fishes* (pages 425-6), Mr. J. R. Norman quotes Dr. Regan's comment that the statements concerning most of the very old carp 'rest on very unreliable evidence,' and adds that, 'although there is good reason for believing that under artificial conditions this fish may attain to a good old age, it is doubtful whether it exceeds fifteen years in a wild state.' This, I think, aptly sums up the position in the case of carp, since these placid fish take very easily to a domestic life.

Both authors are equally sceptical about the alleged great age of certain pike, though Dr. Regan concedes 'it is probable that fish of sixty or seventy pounds weight are at least as many years old.' Mr. E. G. Boulenger (*Angling*, October-December, 1936, page 7) states that 'no pike of over fifteen years is *definitely recorded*' (my italics). Ireland, as is well known, produces some superb pike; yet, so far as I am aware, scale readings, where practicable, have not revealed any evidence of notably long-lived individuals. One of the heaviest Scottish pike netted in recent years—a female fish weighing 35 lb., and measuring 4 ft. in length (Loch Ken, 1935), was estimated, from examination of scales, to be eighteen to twenty years old (*Fishing Gazette,* June 29th, 1935).

Unfortunately, numerous discrepancies are to be found between various authors' accounts of 'long-lived' carp and pike. In some cases even the metal of which the marking ring was composed differs in different stories, some writers having that it was brass, others copper, and yet others insisting on gold! Gesner's marked pike, taken (*circa?*) 1497, was supposed to have been placed in a lake by the Emperor Frederick II in the year 1230, but, as Mr. Norman has pointed out, '. . . they (*i.e.,* other authors) cannot agree as to which of the Fredericks was responsible for marking the fish, or as to the exact locality at which it was finally captured. Its length has been stated to be 19 ft., and its weight *five hundred and fifty pounds*' (my italics).

Incidentally, it would appear that the Teutonic sense of humour was more pronounced in those times than now; for we read (I really must apologise to Mr. Norman for quoting him so extensively!) that the actual skeleton of this monster pike is said to be preserved in the cathedral at Mannheim, but 'a celebrated German anatomist' who studied it during the last century 'found that the vertebrae in the backbone were too numerous to belong to a single individual—in other words, that the skeleton had been lengthened to fit the story!'

'DAVENA,' PETER MICHAEL.
56, CRANMORE LANE,
ALDERSHOT,
HANTS.

XXIV.—ON THE NESTING HABITS OF THE GOURAMI. (*OSPHRONEMUS GORÄMY* [*LACÉPÈDE*]).

The nesting habits of Anabantoids are interesting in that the male constructs a floating nest of air bubbles to the under side of which are attached the eggs deposited by the female. The paternal parental care lasts till the absorption of the yolk in the young larvae which after this are capable of leading an independent existence. The spawning habits of *Colisa fasciata* (*Colisa vulgaris*) and *Osphronemus goramy* which are essentially alike have been given by Carbonnier (1876 and 1877). The breeding habits of *Macropodus chinensis* (*M. opercularis*) are also apparently the same in view of the reference made by Carbonnier in his paper (Carbonnier, 1876). Waite (1904) has given an account of the breeding habits of the Siamese fighting fish, *Betta pugnax* Cantor. There is a short note on the breeding habits of *B. splendens* by Chute (1935). The nesting habit of a South Indian form, *Macropodus cupanus* (*Polyacanthus cupanus*) has been worked out by the present writer (Jones, 1939) and this has been found to be just as in the other Anabantoids.

While engaged in going through the literature connected with the breeding habits of the Anabantoids, the author was surprised to find divergent nesting habits attributed to the Gourami by different workers. The observations of Carbonnier (1877) on the nesting habits of this form is in general agreement with that of other Anabantoids. A few extracts from his account are given below. 'He' (referring to the male fish) 'soon commenced in one of the angles of the aquarium the formation of a nest of froth, which in a few hours attained a considerable size—6 to 7¼ inches in diameter and 4 to 4¾ inches in height.' The life of the bubbles depends on the quantity of mucus contained in them and the fish appears to make a selection of the good bubbles. 'For this purpose he kept at the surface of the water, turning his back to the nest, and drawing in the outer air, expelled it by degrees in front of him in the form of gaseous bubbles. The badly preserved bubbles burst, and there only remained those the envelop of which possessed suitable consistency; these he then collected and carried into his nest.' 'At times the buccal secretion seemed to slacken, and the male could no longer elaborate his globules. He then descended to the bottom of the water to seek for some confervae, which he sucked and chewed for a few moments as if to excite and reawaken the activity of the mucous membrane.' With regard to the behaviour of the male after the eggs have been deposited by the female he says 'A *Macropodus* or *Colisa* would not have been embarrassed about collecting the eggs and arranging them in his mouth; and in order to raise them to the surface he made use of a most curious stratagem. He rose to take in an abundant provision of air; then, descending, he placed himself well below the eggs, and suddenly, by a violent contraction of the muscles of the interior of the mouth and pharynx, he compelled the air collected there to escape by the gill apertures. This air, infinitely divided by the branchial lamellae and fringes, was, so to speak, pulverized; and the violence of the expulsion was such that it escaped in the form of a regular gaseous powder, which enveloped the eggs and conveyed them to the surface.' It takes three days for the eggs to hatch out (Temp. 25°C. = 77°F.) and the paternal care lasts for about another ten days. About 2,000 to 3,000 eggs are laid at a time, and the fish has the faculty to spawn several times a year.

The nesting habit of the Gourami as given by other workers is quite different from the one given above. No reference is made of a floating nest consisting of air bubbles. Weber and de Beaufort (1922), say: 'The eggs are attached to water plants or received in a nest, composed of plants.' Deraniyagala (1929), dealing with the Labyrinthici of Ceylon, says 'This fish is reported to breed when six months old and builds a bird-like nest of mud and weed, to which the ova are attached. The young according to Indian workers, hatch out after a month and are guarded by the parents.' Sundara Raj (1931) in a pamphlet issued by the Madras Fisheries Department says, 'During the breeding season nests are constructed by the fish in the weedy margins of the pond with stems and blades of grass and aquatic plants (*Elodea, Ceratophyllum, Hydrilla,* etc.) and in these the eggs are deposited by the female. The male generally guards the nests. The young fry emerge from the eggs in about a fortnight but if the weather is warm, in shorter times.' In the Fisheries Department Aquarium at the Madras Beach (Marina) the nest of a Gourami resembling very much the nest of a bird can be found exhibited in a show case.

In no other Indian fresh water fish so far as I know a definite nest made of water weeds or grasses is recorded. Apart from the Anabantoids eggs attached to floating mass of air bubbles are not known in any other Indian Fish. In the Ophiocephalids, where we get floating eggs, bubbles of air are absent and the eggs are self-buoyant due to the presence of a large oil globule. Budgett (1901) when dealing with breeding habits of some West African fishes refers to frothy floating egg masses in the case of the Characinid, *Sarcodaces odoe.* In *Gymnarchus niloticus* and *Heterotis niloticus,* two other West African fresh water fishes, nests made out of water weeds are recorded (Budgett 1901).

It is evident from the extracts given already that the nesting habits of the Gourami are different according to different workers. It is rather strange that the same species should exhibit such varied habits. We find that the observation of Carbonnier does not differ from the typical nesting habits of the Anabantoids and therefore one is disposed to consider it as more probable. However this is an interesting problem that requires further investigation.

Since writing the above account a few more references concerning the nesting habits of the Gourami have come to the notice of the writer and the relevent portions in them are given below. It has not however been possible to consult the works of Dabry de Thiersant[1] and of General Hardwicke.[2]

Gilbert has given in this *Journal* (1894, vol. viii, Part 3, pp. 435-8) the following notes on the breeding habits of this form that he observed in an aquarium of about 15 gallon capacity with some ornamental rock work at the bottom consisting of a central curved stone: 'One morning when I came as usual to look at my fish I noticed that some thing unusual had happened; all the fish but one had hidden themselves amongst the weeds and the only visible fish was truly terrifying spectacle. He had turned a jet black and his red eyes by contrast, shone like live coals; his fins were all erect, and he was making furious charges at any of the other fish which ventured to show their noses. Presently I espied another black-looking fish quite motionless underneath the rock-work bridge, and then I understood what was taking place. After chasing away all intruders the male came down to the female under the bridge.'

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[1] La pisciculture et la pêche en Chine, 1872.
[2] *Zool. Journ.*, iv, p. 309.

Immediately after they separated the female emitted a stream of 15 or 20 eggs, and to my disgust the pair immediately set to work (apparently) to gobble them up. One or two eggs which were caught in the eddies and carried down amongst the rocks were immediately snapped up by the other fish which were hanging around for this purpose. This took place several times and at last I noticed that the pair had frequent mysterious visits to the undersides of the hollow stone, but there was nothing there that I could see.'

The next morning these visits were explained and I then noticed the female frequently rising to the surface and bringing down with her a mouthful of air which she let go against the underside of the bridge until there was a large silvery globule accumulated. The eggs had, it appeared, been plastered to the underside of the rock and she was now supplying them with air.'

Every now and then the globule would overflow and a large bubble would rise to the top; she however kept on bringing down more air with the idea, I suppose, of keeping the supply fresh.'

I have already mentioned that these fish seem capable of actually breathing atmospheric air, but what the eggs should want with air, and compressed air at that, I leave others better versed in fishlore to explain. The eggs could hardly have been less safe had the parents put them on the top of a floating leaf, as one or other had to remain constantly on guard to keep away the other fish.'

Another point struck me, which was the great self-denial exhibited by the pair, and more especially by the male; these eggs seemed to be regarded by the other fish as great delicacies, and I could quite imagine a bad husband (and I suppose there are such things amongst fish as amongst other animals) bolting his mouthful of eggs and explaining the contretemps and excusing himself on the grounds of a sudden inclination to cough.'

Jordan in 1905 in his *Guide to the study of Fishes* referring to the work of Hardwicke says (p. 166) 'General Hardwicke tells how the Gouramy (*Osphromenus gouramy*) in the Mauritius, forms a nest amongst the herbage growing in the shallow water in the sides of tanks'. Here one cannot say for certain what kind of a nest he refers to.

Sundararaj (1916, *Rec. Ind. Mus.*, xii, p. 281) while dealing with the fresh water fish of Madras after referring to the works of the previous authors on the subject says 'the nest is of a nearly spherical form composed of plants, preferably tuft of a peculiar grass (*Panicum jumentorum*) which grows on the surface of the water, and considerably resembles a bird's nest in form. It is usually attached to plants or weeds growing at the edge of the pond and the bottom selected is muddy while the depth varies.' According to Darby de Thiersant in natural surroundings the eggs are attached to water plants.

J. A. Thomson in his *The New Natural History*, vol. ii, p. 533 says 'At the breeding season it makes a nearly spherical nest of water grass and the like, and usually fastens it to plants growing at the margin of the Pond. At this time the fish assumes a jet black colour and flashing red eyes, and becomes very pugnacious in defence of the nest. The Gourami is one of those fishes that can use dry air gulped in at the surface and a very interesting fact is that every now and then the mother brings down a mouthful of air and discharges it upon the eggs, thus securing their thorough aeration. Here we have a fish puffing air on its eggs! Surely that is *experimental*.' On page 536 of the same work, under the photograph of a Gourami he says 'This malayan fresh water fish, acclimitised in India, the Guianas and Mauritius, is famous for the bubble nest that the male constructs and guards. It is made of air bubbles entangled in a mucous secretion from the mouth. The fish itself may grow to be two feet long, and is very palatable.' The two statements are contradictory.

Boulenger (*Zoo and Aquarium Book*, 1932) gives the figure of a bubble nest of *Macropodus opercularis* (= *M. viridiauratus*) with the parent guarding the nest and producing fresh bubbles in the place of those lost.

It has not been possible for the present writer to observe the nesting habits of the Gourami. Gilbert's observations tally with those of Carbonnier in that the male makes a bubble nest as all other Anabantoids whose breeding habits are known. It is however difficult to conceive the same species exhibiting two quite different nesting habits even granting conditions are different. Habits like these are derived by instinct and as such it is impossible for them to get changed under different conditions. In the author's opinion one should consider a bubble nest as the natural and probable one in the Gourami till it is definitely proved to be otherwise.

I am indebted to Mr. S. H. Prater and Dr. S. L. Hora for clearing my doubts, regarding the nomenclature of certain Anabantoids and to Mr. L. de Fonseka of the Colombo Museum Library for sending me certain extracts dealing with the breeding habits of the Gourami.

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TRIVANDRUM. S. JONES.

[A mistake in the identity of the species concerned probably accounts for the extraordinary divergence in the nesting habits of the Gourami as described by various authors. It is possible that the species whose nesting habits were described by M. Carbonnier (*Ann. Mag. Nat. Hist.*, vol. xix, p. 274, 1877) was not the true Gourami (*Osphronemus gorämy* Lacépedé) but one of the other Anabantoid fishes which habitually constructs a 'bubble' nest. Many fishes of this group bear a general resemblance in form and have the same distinctive prolongation of the ventral fin rays into long thread-like appendages, and require for their correct identification a little more than the cursory examination possible through the glass of an aquarium. Further, it should be indicated that the popular name of Gourami has been generally applied not only to the true *Gourami* (*O. gorämy*) but to various Anabantoid fishes of different genera such as *Trichogaster, Colisa, Helostoma* and *Trichopsis;* some of which, such as *Trichogaster trichopterus,* and *Trichopsis vittatus,* were formerly included, with the true Gourami, under the genus *Osphronemus.* Dr. Kyle (*Biology of Fishes*) gives the name Gourami to fishes of the genus *Trichogaster* and illustrates the bubble nest of *Trichogaster labiosus* (=*Colisa labiosus* Day) which he calls the Thick-lipped Gourami. *Colisa labiosa*, like the true Gourami, is marked with irregular bands across its sides; only these markings are more vividly coloured —light, blue-green bands alternating with darker bars of orange brown. Another distinctive feature in this species is that the lips of the male are thickened and more prominent than in the female. The true Gourami on the other hand is a sombre coloured fish, its general colour is dark brown with a few irregular whitish bands across the body. Also in this species there is no marked and prominent thickening of the lips in the male. Carbonnier, in his description of the nesting habits, gives no clue to the colouration of the nest builder, he refers however to the 'brilliant' colours of the male—a character by no means strikingly apparent in the true Gourami. Further his description of the lips of the male which he says were 'tumefied in an abnormal fashion' seem to indicate that the species he was dealing with was not the true Gourami (*O. gorämy*) but *Colisa labiosa* Day, formerly known as *Trichogaster labiosa,* the thick-lipped Gourami, which habitually builds a bubble nest. Gilbert's description of the nesting habits of the *'Gourami'* which appeared in the Society's *Journal* is probably again a case of mistaken identity. He describes his

Gourami as 'jet black with red eyes' a description which hardly fits the colouring of the true Gourami. Further he expresses surprise that his 'Gourami' weighing not more than three or four penny weights should breed. The average weight of the breeding Gourami would run into as many pounds and more. The necessity for careful identification of the species in recording breeding habits is made clear. Writers who have subsequently referred to the 'bubble nest' of the true Gourami have probably accepted Carbonnier's original description. The most recent of these is Innes (*Exotic Aquarium Fishes,* 1935) who writing of the Gourami (*O. gourami*) refers to them as 'bubble nest' builders and qualifies his account by stating that they do not usually breed in aquaria. Which is probably correct as the usual type of aquaria do not provide these fishes with the conditions or the facilities for constructing the 'nest' of reeds which they build for the reception of the eggs.—EDS.]

XXV.—FRESH WATER FISHES OF NORTH GUJRAT.

This is a list of fishes collected in one season in 1936 from the Sabarmati River and one or two tanks neighbouring Ahmedabad. These specimens were originally to form part of an extensive collection from all sources around this city, but owing to unavoidable circumstances, the work was indefinitely postponed.

The fishes collected by the author, together with some other from Prof. J. J. Asana of the Gujrat College, were submitted to Dr. S. L. Hora who very kindly identified and named them. Each of the species mentioned has got a separate Gujrati name, but due to conflicting nomenclature prevalent here, it is thought advisable not to include the vernacular synonyms in the present note. In a future note, it is intended to give these, together with new material; also an attempt will be made to give a short description of the several fishing places which provide for the Ahmedabad market and information on the economic side of the Fishing Industry in this part of the Presidency.

The present collection has been handed over to the Gujrat Natural History Society for their museum.

MASTACEMBELIDÆ.

1. *Mastacembelus pancalus* (Ham.).
2. *Mastacembelus armatus* (Lacep.).

NOTOPTERIDÆ.

3. *Notopterus notopterus* (Pallas).

CYPRINIDÆ.

4. *Labeo fimbriatus* (Bloch).
5. *Labeo calbasu* (Ham.).
6. *Labeo dussumieri* (C. & V.).
7. *Labeo potail* (Sykes).
8. *Labeo boggut* (Sykes).

9. *Labeo* sp. young specimens.
10. *Cirrhino cirrhosa* (Bloch).
11. *Cirrhina reba* (Ham.).
12. *Amblypharyngodon mola* (Ham.).
13. *Barbus sophore* (Ham.).
14. *Barbus sarana* (Ham.).
15. *Barbus arulius* (Jerdon).
16. *Barbus ticto* (Ham.).
17. *Barbus* sp. (Large-scaled Barbel).
18. *Barilius bendelisis* (Ham.).
19. *Chela clupeoides* (Bloch).

BAGRIDÆ.

20. *Mystus cavasius* (Ham.).

SILURIDÆ.

21. *Wallago attu* (Bloch).

XENENTODONTIDÆ.

22. *Xenentodon cancila* (Ham.).

OPHICEPHALIDÆ.

23. *Ophicephalus punctatus* Bloch.

AMBASSIDÆ.

24. *Ambassis ranga* (Ham.).

GOBIIDÆ.

25. *Glossogobius giuris* (Ham.).

AHMEDABAD, H. G. ACHARYA,
NORTH GUJRAT, F.Z.S.
September 6, 1938.

XXVI.—A CASE OF POISONING FROM THE BITE OF A SPIDER.

In the accompanying parcel I am sending you a large black Tarantula-like Spider. I think it is dead but please be careful when opening the tin. I did not know one got these creatures in India. My *mali* was cutting some low jungle in the garden yesterday when it ran up his arm and bit him near the elbow. His arm began to swell immediately and became very painful. The swelling had the appearance of a lump with small blisters beneath the skin, covering an area of some four square inches. He found it difficult to bend the elbow after about two hours. After treatment the symptoms subsided within 24 hours except for a slight stiffness and soreness. There was no fever. The bite drew blood in one place. Could you very kindly name the spider for me and be so good as to let me know if its occurrence is at all rare.

GAUHATI,
KAMRUP DISTRICT, R. E. PARSONS.
ASSAM.
October 29, 1938.

[The spider referred to by Mr. Parsons is one of the large Mygalomorph spiders, commonly known as 'Tarantulas'. It has been identified by Dr. Gravely as *Cheliobrachys* sp. The name *Tarantula* is derived from Tarentum a town in Italy, and originally was applied to a species of Lycosid or Wolf Spider which is common in the Mediterranean countries. The term is now generally extended to the large Mygalomorph spiders so widely distributed in the tropics of which a number of genera and species occur in India. The most remarkable of the Indian forms are the spiders of the genus Poeicilotheria; great hairy creatures some large enough to cover the span of a man's hand. Despite their forbidding appearance, these spiders do not usually bite except under extreme provocation. All spiders possess a pair of poison glands opening near the tip of the fangs, but few seem to have the power of injecting their poison into human beings. It is believed that the poison is not automatically injected whenever the fangs are used but is under the spider's control and that the venom is economised when a simple wound is sufficient for the purpose. This probably explains the divergent views regarding the effect of a spider's bite. We have no precise knowledge regarding the effects of poisoning by the various Indian forms of Mygalomorph spiders. Dr. Gravely in his article on Indian Spiders (*J.B.N.H.S.*, xxviii, p. 1045) refers to a case communicated to him by Dr. Sutherland of Kalimpong in which a boy of 14 years was bitten in the finger by a well grown female of the species *Macrothele vidua*. The pain extended up to the arms and down the side. After 24 hours the finger was still swollen. In a second instance recorded by Dr. Gravely, the victim of a much larger species *Chilobrachys fumosus* suffered no ill effects beyond a slight local swelling. Dr. Gravely suggests that the feeble effects in this instance might have been due to the spider having emptied its poison glands under the irritation to which it was previously subjected. Drops of poison were seen exuding from the tips of its fangs. No precise experiments have been carried out with the Indian species: but Mons. B. Houssay has demonstrated that some of the large Mygalomorph spiders of the Argentine are highly venomous to animals and present some danger to man. Full grown rabbits, guinea pigs and pigeons may be killed in a few minutes. In Man the bite of certain species produces intense pain, local swelling accompanied with fever and delirium and may in children and persons in ill health, result in death. Aguilar (*Rec. de la Soc. Med. Argentina*, xvi, 1908) records the death of a child of 7 years who succumbed to the effect of the bite of one of these large spiders, 7 days after being bitten. There is also the authenticated case (*Insect Life*, I, 1889, p. 205) of the death of a farm labourer bitten by a spider *Latrodectus mactans*. In this instance the victim was bitten at half past eight in the morning and died between 11 and 12 o'clock in the night. Small pimples were raised in the neighbourhood of the bite. Intermittent pains and spasms ended in a comatose condition from which the man did not rally. *Latrodectus* is a Theridid whose poisonous reputation almost rivals the Tarantula. It is regarded as particularly dangerous in such widely spread regions of the world as Madagascar, New Zealand, Algeria, the West Indies and North America.—EDS.]

XXVII.—ON THE OCCURRENCE OF CERTAIN BUTTERFLIES AT NASIK.

1. **Gomalia elma albofasciata** (African Marbled Skipper).

A single specimen of this insect, a male, was taken in a garden in Nasik in June 1938. It is at present in my private collection and is available for examination if required. According to Evans, *Identification of Indian Butterflies*, this insect is shown to range from South India as far North as Poona and to be rare everywhere, it appears from this that its occurrence in Nasik, some distance North of Poona is even more rare, being at the extreme limit of its previously recorded range.

2. **Kallima philarchus horsfieldii** (Blue Oakleaf).

A specimen of this butterfly was taken in December 1938 in a garden in Nasik. The one taken was a female, and is in fairly good condition, only one hind wing being slightly damaged. Another of the same species was seen, but not taken, near Bhandadara, some 40 miles from Nasik during the month of August. The identification has been made by reference to the same authority.

NASIK, C. J. RAE,
January 3, 1939. *Executive Engineer.*

XXVIII.—AN IMPROVED CELLOPHANE WING MOUNT.

In a previous note (1936 *Journ. Bomb. Nat. Hist. Soc.*, xxxviii, 634) I described a method of mounting the wings of Lepidoptera on cards under cellophane. Time has shewn that the method then described is not altogether satisfactory and the present one has been evolved in order to get over the various drawbacks.

Materials required:—Visiting, or other suitable, cards, moisture proof cellophane and a suitable adhesive, such as Gripfix. Moisture proof cellophane should be used in preference to ordinary as it is not affected by changes in humidity.

A suitable sized window is cut out of one card (the cover) with a sharp knife or razor blade and any projecting edges at the back of the cut scraped down. The size and position of the window is then traced with a sharp pencil on a second card (the support). A piece of cellophane, slightly larger all round than the window, is then cut out.

The wings to be mounted are severed as close to the point of attachment as possible, a razor blade is the most satisfactory instrument to use for this, but care must be taken to see that no shred of flesh or muscle is attached as this will give rise to mildew in the finished mount.

A film of the adhesive is then brushed over the previously pencilled window on the supporting card, the wings placed in position with a pair of fine pointed forceps, the cellophane put in place and pressed down and the whole thing is then put in a heavy book or under a weight and left for twelve hours or until it is completely dry.

The support and cover are then pasted together and allowed to dry under pressure, after which the name, locality and date can either be written on the mount itself or typed on a separate slip and stuck on.

Calcutta. D. G. SEVASTOPULO,
October 13, 1938. F.R.E.S.

XXIX.—THE ORIGINAL HOME OF THE COCONUT.

(A correction).

From the citation in Dr. H. N. Ridley's monumental work *The Dispersal of Plants throughout the World*, p. 321, I had assumed that Peter Martyr himself had visited the Moluccas. Later I could see that he was the historiographer of the court of Spain and wrote the history of the voyage of Magellan and his followers round the world under orders of Charles V who placed into his hands all the journals of that voyage.[1] Thus the sentence beginning with Peter Martyr in the text on page 177 of my paper on the 'Original Home of the Coconut' in the September number of this *Journal*, vol. xl, No. 2 has to be altered in the following manner. Peter Martyr who wrote the history of the voyage of Magellan and his followers round the world has recorded that in the Moluchas Islands (Moluccas) the coccus (coconut) grew quite accidentally (1521).

This minor error could have been avoided had I been able to look into Dr. Ridley's reference firstly. However, the following two references may be relevantly let in with this.

Antonio Pigafetta,[2] one of the lucky survivors of Magellan's terrible voyage and a man of letters, had kept his notes of the voyage himself after giving a copy of it to Charles V. His account was separately published, though in a somewhat mutilated form, in France and later in Italy. He has given an elaborate account of the uses of the coconut in the islands of the West Pacific and has recorded its occurrence in an island, between Moluccas and Timor, inhabited by savages who were more beasts than men and who were anthropophagi. Saavedra[3] sailing in a southerly direction from New Guinea in 1529 found many small low islands full of palm trees (evidently coconut) at 10° or 12° S. latitude. The people of those islands knew no fire and ate cocos instead of bread and raw fish. 'They break cocos before they be ripe and putting them under the sand, and then after certain daies they take them out and lay them in the sunne, and then they will open.'

MADRAS.

P. V. MAYURANATHAN,
Curator, Botany Section,
Government Museum, Madras.

October 10, 1938.

REFERENCES.

[1] Pinkerton: *Voyages and Travels*, vol. xl, p. 299.
[2] *Ibid*, p. 374.
[3] Galvano: *Discoveries of the World.* Hakluyt Society's Publication, pp. 178 and 179.

XXX.—OCCURRENCE OF TWO PLANTS NEW TO KASHMIR.

During the course of his limited scope of work as a Forest Ranger, the writer found to his great surprise *Lilium giganteum* Wall., growing wild in the Kishenganga Valley. Curiously enough the plant is localised in a single place, far away from habitation and in a steep nala where the possibility of its introduction by human agency is remote. This species, so far as the writer thinks, has not been recorded west of the Sutlej up to now. The only reference of its existence in the Punjab is by Collett in Narkanda.

A specimen of Iris collected in the Liddar Valley was sent to Kew and identified as *Iris Milesii* Foster. No record about its collection west of Kulu is available.

The writer would be interested to know if any of the readers of your *Journal* has come across or known of these two plants having ever been collected west of the Sutlej and the Ravi respectively.

FOREST SCHOOL,
BANDAPORE—KASHMIR.
September 28, 1938.

PREM NATH KOHLI.

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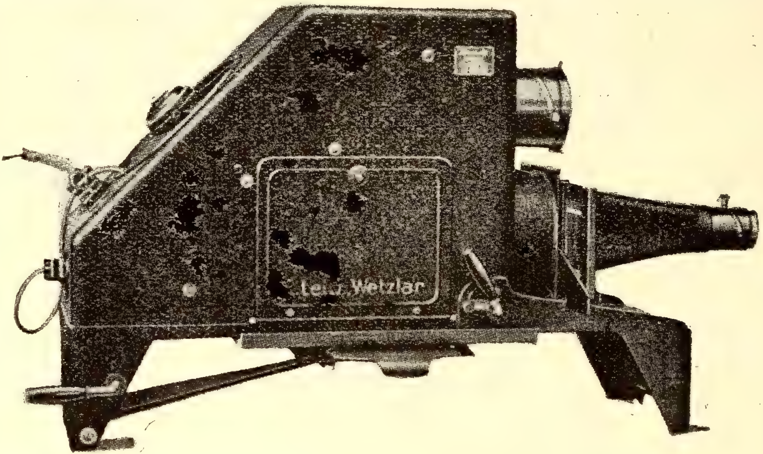

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